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BETTER FRUIT

April 1907

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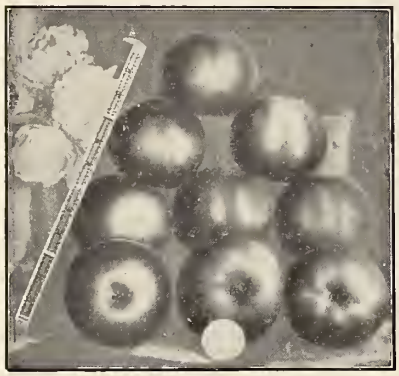

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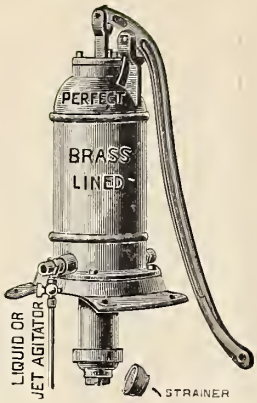

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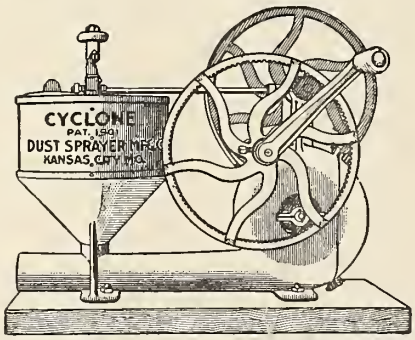

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BETTER FRUIT

A MONTHLY ILLUSTRATED MAGAZINE PUBLISHED IN THE INTEREST OF UP-TO-DATE AND PROGRESSIVE FRUIT GROWING AND MARKETING

CONTROL OF THE CODLING MOTH AND APPLE SCAB

BY C. L. MARLATT, BUREAU OF ENTOMOLOGY AND W. A. ORTON, BUREAU OF PLANT INDUSTRY

THE codling moth or apple worm and the apple scab have no direct relationship except that both attack the apple and are, respectively, the chief insect enemy and the chief fungous disease of this fruit. Both are, however, subject to practical control by sprays, which being necessary at the same dates, in the main, can be combined in single applications, and it is for this reason that they are considered together in this bulletin. A brief life history is given of the codling moth, with a description of the sprays and other remedies for it, followed by similar matter on the apple scab. The bulletin concludes with a joint consideration, for both pests, of spraying outfits and methods, with directions for the combination of spray mixtures, and a spray calendar.

THE CODLING MOTH

Losses Due to the Codling Moth

The codling moth or apple worm is a familiar pest to every grower or consumer of apples, and a wormy apple, the result of its work, scarcely needs description. The larva, living most of its life within the fruit, throws out through its entrance hole, which it enlarges from time to time, or through its exit hole in the side of the fruit, the characteristic mass of frass or excrement which is the sign of infestation. Such an apple is practically unsaleable, either for consumption or for working up into cider. The monetary loss thus occasioned by this insect is greater than that due to any other insect pest affecting fruits.

It has been shown by careful estimates in various apple-growing States that this insect may cause a loss of from 20 to 40 per cent of the fruit which would otherwise be sound and merchantable. Without going into details this loss, on the lowest or 20 per cent basis, will amount annually to $11,400,000 in the United States and this does not include the expenditures for spraying trees with arsenicals, which amount to more than $8,000,000 additional, indicating a total loss chargeable to the codling moth of nearly $20,000,000. Great as this loss still is, it has been very much limited by measures of control which are becoming more and more widely adopted, and many apple growers in badly infested regions are now saving every year more than 85 per cent of fruit which would, without treatment, be wormy.

The following account of the codling moth with directions for control, is abbreviated and recast from Farmers' Bulletin No. 171, by Mr. C. B. Simpson, formerly a special agent of the then Division of Entomology, who made a three years' investigation of the codling moth in the Northwest.

Distribution

The original home of this insect was probably Southeastern Europe, the home of the apple, but it has followed closely upon the distribution of the apple until it is now found in almost every country in the world. It is spread principally by the shipping of the infested fruit. The young larvae in such fruit complete their development, and leaving the fruit, spin cocoons on the crates or near by, the moths emerging in due course and flying to the nearest orchard to deposit their eggs. When orchards are but a little distance apart the moths may fly from one orchard into another.

Fruits Infested

The apple is the natural food of this insect, and sustains almost all the loss occasioned by it. Pears are next in order of infestation, but if apples are present in the same orchard, pears are usually not badly infested. The codling moth larvae have been found also in the fruit of quince, prune, plum, peach, and cherry, but never in sufficient numbers to cause any great injury.

Life History

Every fruit grower should familiarize himself with the different stages of this insect by studying it in his own orchard, so that he will understand the principles of control, which are based on certain vulnerable points in its life cycle.

Hibernation—The codling moth passes the winter in the larval stage in silken cocoons in cracks and holes in the trees and in houses where apples have been stored. In the spring these larvae change to pupae, and the moths emerge about a month after the apple is in blossom.

The Moth—The moth is but little known among fruit growers, and other moths are often mistaken for it. It varies somewhat in size, but the maximum spread of its wings is about three-fourths of an inch. The front wings are of a brownish gray color and are crossed with lines of gray scales, giving them the appearance of watered silk. At the tips of the wings there is a large brown spot, in which are many scales of bronze or gold. The hind legs are grayish brown in color. Taken as a whole, the coloring of the moth is such that when resting on old grayish bark it is so like the bark

Nine Year Old Mosier Valley Spitzenberg Tree, Producing Ten Boxes of Apples, Which Sold for $26.00

that it is not easily distinguished. The moth lays her eggs, a few days after emergence, on the leaves of apple or other food plant, or on the fruit. A majority of the eggs of the first generation are laid on the leaves, while the greater part of those of the second generation are laid upon the fruit.

The Eggs—The eggs are very minute, scarcely visible to the naked eye, and pearly white in color, resembling thin convex disks. Around the edge there is a coarse network of ridges; while toward the center these ridges are finer. A red ring, which indicates the embryo or developing larvae, appears in the egg a few days after it is laid. In about eleven days, varying somewhat with temperature, the young larva breaks its way out of the shell and seeks to enter the fruit.

The Larva—This is the most important stage of the insect, for not only does it work its injury in the larval condition, but that is the stage in which it is most amenable to remedial measures.

A large number of the larvae which hatch from eggs deposited on the leaves eat small portions of the leaves before finding fruit. The larvae have some difficulty in entering the smooth sides of the fruit, and about 80 per cent of the first generation enter by way of the calyx, while the majority of the second generation enter at the sides, especially where the fruits are touching.

Before entering the young apple the larva feeds, as noted, on the leaves, but also for a day or two within the partial concealment formed by the calyx or blossom end of the apple. During several days, therefore, the little apple worms feed externally, both before they enter the calyx and within the latter, and the object of spraying is to insure their being poisoned by thoroughly coating in advance, with an arsenical mixture, the leaves, and especially the blossom end of every fruit, before the shutting up of the lobes of the calyx. Most of the larvae enter the calyx after it is closed, and are then beyond the reach of any poison later applied.

The pinkish larva lives in the fruit about twenty days, and grows to a length of about five-eighths of an inch, when, being full fed, it makes a tunnel to the outside of the fruit, the entrance of which is filled with frass and silk. When ready to leave the apple this plug is pushed out. The larva then crawls out and immediately seeks a place in which to spin its cocoon.

The Cocoon—Cocoons have been observed in the following places: In holes and cracks in the trunks and branches of the trees; under rough bark; in the fruits (though rarely); in the cracks in the ground around the tree; on or between the clods among the fallen fruit; under bands or anything else resting on or against the tree; in cracks and angles of the walls and roof of the building in which apples are stored; under shingles of buildings near apple trees; in fence posts and under pickets of near-by fences; in paper or other rubbish on the ground; and in various other places. The cocoons of the first generation are composed entirely of silk, while in those of the second generation are incorporated bits of wood and bark. The larvae inside the cocoons transform into pupae in about six days from the time of spinning the cocoon.

The Pupa—The pupa is yellowish at first, but changes to a brown, and later to a bronze color. In about twenty days from the spinning of the cocoon the pupa, aided by its spines, pushes its way out of the cocoon. The pupa skin splits and the moth emerges, lays its eggs, and gives rise to another generation. The average life cycle of the insect is about fifty days.

Mosier Valley Newtown Pippin

Generations of the Insect

In the principal northern apple-growing sections of the United States, as, for example, New York and Maine, the insect has but one full generation, with only a partial second. In the warmer portions of the East and West two generations are found, and in the Southwest and South a partial third generation has been distinguished. Where two full generations occur, the members of the second are much more numerous and destructive than those of the first. The dates of the different generations will vary in a given locality with the season. Taking Nebraska as representing the upper Mississippi Valley region the first brood of the codling moth will pass from the egg to the moth stage between June 1 and August 15, the majority of the moths emerging between July 20 and August 15. The second generation overlaps the first, beginning in the egg stage about the end of July and running on to the end of the season, the larvae of this generation hibernating. In the Southwest some of these larvae may transform to moths and give rise to a partial third generation.

Natural Enemies

There are many natural enemies of the codling moth which may be encouraged with advantage. It has often been noted that no larvae can be found under the rough bark of the trees in the spring, while many are found in cracks and holes in the trunks, branches and stubs. Under the rough bark many cocoons can be found from which the larvae are missing, and in these cases the telltale hole made by a woodpecker can always be found. Destroying or rendering unsuitable the more secure places for spinning, thus forcing the larvae to spin cocoons where the birds can get them, will result in destroying many of the insects.

Measures Used Against the Codling Moth

The first essential in combating this insect is for the apple grower to familiarize himself with its history. By doing this he is better prepared to understand the remedial measures recommended, and can modify them to suit his local conditions.

Remedies of Little or No Value

It is sometimes as well to know what not to use against an insect as it is to know what to use. The following remedies have been suggested at various times and found to be of little or no value: Moth balls hung in the trees and supposed to keep moths away; smudging or spraying orchards with various ill-smelling compounds; plugging the trees with sulphur; plugging the roots with calomel; banding trees with tarred paper to keep the larvae from crawling up the tree; trap lanterns; baiting the moths with a mixture of vinegar and molasses; spraying with water; and electric lights as a repellant of the moth. These so-called remedies have been tried so often that a fruit grower is simply wasting his time and money when he uses them.

Banding

The use of bands to trap the full-grown larvae of the codling moth was the only remedial measure of value employed before arsenical sprays were discovered. If an orchard has been given good care, and spraying is thoroughly done, it may be unnecessary to use bands. If, however, the trees are old and cracked, and have holes in the trunks and branches or are planted close together, so that

spraying is difficult, the use of bands will materially aid in bringing the insect under control.

Banding for this insect is simply affording it a good place to spin its cocoon, and killing the larva or pupa after it has gone beneath the band. Cloth bands, from 10 to 12 inches in width, are folded once lengthwise and placed around the tree. They can be fastened in such a way as to be easily removed and replaced, by driving a nail through the ends and then nipping off the head at an angle so as to leave a sharp point. If a tree is large, one band should be placed on the trunk and one on each of the larger limbs. Cloth bands of any heavy, dark-colored stuff are much preferable to bands of hay or paper. When bands are used, the trees should be scraped clean of rough or loose bark, to leave as few other attractive places as possible in which the larvae might spin cocoons. Inspection of the bands should be made regularly at intervals of ten days, and all larvae and pupae found beneath them should be destroyed with a knife. If used alone, banding is but little effective in badly infested localities, but it is a most valuable adjunct to spraying. Under no circumstances should banding be used as a substitute for spraying.

Some of the 10,000 boxes of Mosier Valley apples that sold at $2.50 to $4.00 per box

Spraying With Arsenicals

Spraying with some arsenical is now recognized as the best means of controlling the codling moth. The object, as noted elsewhere, is to poison the young larvae before they enter the fruit. The larvae get the poison while feeding on the leaves, or in the calyx, or on the sides of the fruit, and are killed. There are several of the arsenical compounds upon the market, and others which the fruit grower can prepare himself. The most available and best are described below.

Paris Green—Paris green is probably the best known of these arsenicals. It is a definite chemical compound of arsenic, copper, and acetic acid, and should have a uniform composition. It is a rather coarse powder, and has the fault of settling rapidly. It costs about 20 cents a pound, but varies in price from year to year with the fluctuation in the cost of the ingregients. It is prepared as follows:

Paris green, pounds	1
Lime, pounds	3
Water, gallons	150

The lime should be fresh and should be slaked in quantities as required. Mix the Paris green with a little water until a paste is formed, and then add this to the required amount of water, to which the lime has been added. A good average strength to use is 1 pound to 150 gallons, but it must be weaker on trees with delicate foilage. Many fruit growers are using it on apple trees as strong as 1 pound to 100 gallons.

Arsenate of Lime with Soda—In the preparation of this insecticide the following formula may be used:

White arsenic, pounds	1
Sal soda (crystal), pounds	4
Water, gallons	1

The above ingredients are boiled until dissolved, which will be in a very few minutes, and the water lost by evaporation is then replaced. To 40 or 50 gallons of water a pint of this stock solution and 3 to 4 pounds of freshly slacked lime are added. This excess of lime is always desired by fruit growers, as they can then see by the amount and distribution of the lime on the foilage how well the spraying has been done. This formula has been thoroughly tested and has been found to be not only as efficient as the other solution, but far cheaper.

Scheele's Green—Scheele's green is similar to Paris green, but differs from it in lacking the acetic acid. It is a much finer powder than Paris green and more easily kept in suspension, and it costs only about one-half as much. It is employed in the same way as Paris green.

Precautions to Avoid Poisoning—At all times the greatest care should be taken to prevent accident with these compounds, which are of the most poisonous nature. All packages, boxes, or bottles containing these materials should be plainly labeled and kept under lock. The utensils with which the mixtures are prepared should be thoroughly cleansed after use.

The method of application, spraying dates, and the apparatus to be used, are discussed together for both the codling moth and the apple scab.

APPLE SCAB

Losses Due to Apple Scab

Apple scab is perhaps the most destructive fungous enemy of the American fruit grower, particularly in the North, occupying among diseases a position ranking with that of the codling moth among the insect foes of the apple. Its injuries are greater than are generally appreciated, both in effect and extent. The yield of fruit per tree is greatly lessened whenever scab is present: (1) By the premature dropping of young apples, due to the attacks of the scab fungus on flowers, stems, and fruits soon after the blossoms fall; (2) by the smaller size of the scabby apples that mature, and (3) by the loss, just before picking, due to the fact that scabby fruit does not cling well to the tree and is more easily blown off; (4) the value of the fruit harvested is greatly diminished, since spotted apples must be placed in a lower grade and sold for less than clean fruit; (5) their keeping quality also is impaired, as molds and other fungi which cause decay gain entrance through the scab spots and increase the loss during storage.

Nor is the damage confined to the fruit. The leaves also are attacked by the fungus, and the resultant spotting and distortion considerably lessen the vigor and general health of the tree.

The aggregate loss from scab is enormous, amounting to many millions of dollars every year. This is a most oppressive tax on the farmer, since it is unnecessary. An effective remedy is available in Bordeaux mixture. The experience of many years has demonstrated that the loss from scab may be almost entirely prevented by thorough and timely spraying, which is considered by the leading fruit growers throughout the country to be an indispensable orchard practice.

Cause

Apple scab is caused by the summer or conidial stage of a fungus found in its perfect form on dead apple leaves. The disease appears first on the leaves shortly after they unfold, the first infections having come from spores blown by the wind from the dead leaves of the previous season. The olive green, velvety spots on the leaves and fruit produce great numbers of spores, which spread the scab broadcast. In a favorable season the flowers and very young fruit and its pedicels are attacked also. The fungus grows in this manner throughout the summer and autumn. In late autumn and winter the Venturia or perfect stage is produced on dead apple leaves on the ground. The relative severity of the disease is influenced by a number of factors, chief of which is the weather. A low temperature and abundant moisture favor the development of the fungus, and consequently scab is worse in cool, damp seasons.

Cultural conditions in the orchard influence the scab fungus as much as they do the codling moth. Neglected, unpruned, and uncultivated trees are more subject to scab, and careful attention to the general condition of the orchard will always be profitable in connection with spraying.

Varieties of apples differ somewhat in their susceptibility to scab, though not to an extent that will make it worth while to plant resistant varieties with the idea of avoiding the necessity of spraying.

How to Make and Use Bordeaux Mixture

For spraying apples, the following is a formula which has given good results:

Copper sulphate (bluestone), pounds	4
Lime, pounds	5
Water, gallons	50

When the apple scab is bad and the season wet, 5 pounds of the copper sulphate should be used.

Selection of Spray Outfits

In selecting spray pumps from catalogues, the number and size of the trees are the principal factors to be considered.

For home orchards of small size a good equipment consists of a hand barrel pump, 15 feet of ⅜-inch hose, one 8-foot bamboo extension rod, one double Vermorel nozzle; cost of outfit, $12 to $18.

For a medium-sized orchard choose a slightly larger pump of the same pattern, and equip it with two lines of hose, two double Vermorel nozzles, and two bamboo extension rods; cost, $25.00 to $30.00.

For a large orchard select a double-cylinder pump of large capacity, operated by an upright lever. Four to six leads of hose can be supplied in this way. Such an outfit, including a 100-gallon tank, costs from $75 to $90.

The Hose and Extension Rods.

Nothing contributes more to success in spraying operations than satisfactory hose and nozzles. In ordinary spraying operations with the barrel pump, half-inch hose is commonly used. As a rule, however, for the barrel pump three-eighths or one-fourth-inch hose is better. The lighter hose is easier to handle and is less likely to kink and break. Good three-ply or four-ply hose in either case should be bought. It usually does not pay to attempt to use cheap hose in spraying. The couplings should be of a style readily adjusted in the field by means of a screw-driver, and everything must be kept tight to withstand pressure, especially in case of the power outfits.

The ends of the hose should be attached to extension rods of suitable lengths for the work. Occasionally in getting up a very cheap outfit one-fourth-inch iron gas pipe may be used. It is heavy and clumsy, however, and is only a temporary expedient at best. For all lengths above six feet a bamboo extension rod is recommended. This consists of a small brass tube supported by a bamboo rod. The most important part of the whole apparatus is the nozzle. This feature has been neglected by pump manufacturers, and many inferior nozzles have been sent out to farmers. There is a tendency to improvement in this direction in the past two years, however. Good results in the application of the spray mainly depend upon the efficiency of the nozzle. For most purposes the best nozzle is the Vermorel, or a nozzle of that type.

Method of Spraying.

Thorough Work Essential—It is most important that spraying should be done thoroughly. Most of the failures are due to superficial work. The whole surface of every bud and leaf should be covered. Any portion left unsprayed is subject to the attack of the scab fungus or may allow a codling-moth larva to escape.

Overspraying To Be Avoided—The operator should endeavor to deposit the spray in the form of a fine mist, covering the leaves with small drops, and should be careful to stop at this point, viz, before the mixture collects in larger drops and drips from the tree. Less will be left on the leaves if the spraying is continued too long and an unnecessary amount of the mixture is used.

Cost of Spraying

The cost of spraying varies so greatly under different conditions that only approximate figures can be given. The varying factors are the wages and efficiency of the labor employed, the capacity of the spraying outfit (the work can be done cheaper with a large outfit than with a small one), the size and condition of the trees, the conveniences provided for preparing and holding the mixture, the nearness to water, etc., and lastly, the cost of materials.

The cost of the different arsenicals varies rather widely. Lime arsenite with soda is cheapest; its cost being little more than one-quarter that of either Paris green or lead arsenate and about one-half that of Scheele's green. The fruit grower can judge for himself whether it is worth his while to go to the trouble of home preparation of the cheaper arsenicals.

Bordeaux mixture prepared fresh at home is both cheaper and more effective than the ready-made article. The farmer should by all means make his own mixture. Bluestone fluctuates in price, but is obtainable in moderate quantities for about 7 cents per pound.

A Scene on Sixth Street, Portland—Where some of the funds derived from Hood River and Mosier Valley apple growing have been invested

Materials for spraying 100 trees with Bordeaux mixture and arsenicals can be had for from $2 to $3. The cost of application is likely to equal the cost of the materials. Records of the actual expense incurred in spraying orchards vary from 10 cents to 30 cents per tree for the entire season's work of three to six sprayings.

Spray Injury to Foliage or Fruit.

No injury should result from the sprays recommended in this bulletin if properly prepared and applied, though such injury is occasionally reported to occur under unusual weather conditions or when mistakes have been made. This is indicated by the burning of the leaves, especially of the tips and margins, and a russeting of the fruit. To avoid this injury, follow directions exactly. Take special care to have the lime pure and freshly slacked. An excess of lime will do no harm and should be used if any spray injury is observed. Do not use more bluestone or arsenical than advised.

When to Spray for the Codling Moth and the Scab.

It is practicable to combine most of the sprayings for the codling moth and the apple scab and thus lessen by one-half the cost in time and labor. The arsenical may be added to the diluted Bordeaux mixture at the same rate as to pure water, and the lime in the Bordeaux mixture will act as an additional preventive of scalding from the arsenical and obviates the necessity of adding lime to take up free arsenic. The dates of spraying for the first brood of the codling moth and for the apple scab are the same except for the first treatment for the scab, which should be made after the leaf buds unfold but before the flower buds open and is the most important application for this disease. The arsenical in this first application has no relation to the codling moth, which has not yet appeared, and it is sometimes omitted; but its addition costs very little, and it will reach the cankerworm, bud moth, and curculio. The subsequent sprayings apply to both the codling moth and the apple scab, and the arsenical should always be added to the Bordeaux mixture. The second spraying should be made just after the blossoms fall and before the calyx closes, and is the most important of the sprayings for the codling moth, getting the poison into the open calyx, where it will subsequently destroy the larvae before the latter can penetrate into the apple. The third and fourth combined sprayings should follow at intervals of fifteen days. In the case of the codling moth these destroy the young caterpillars on the leaves before they reach the fruit and in their feeding about the calyx, and assist in the control of the apple scab. A fifth combined spraying may be given thirty days subsequent to the fourth, but this is optional in the case of both pests and will depend on the amount of probable infestation of either codling moth or apple scab. Later sprayings against the codling moth are directed against larvae of the second generation when they are entering the fruit, and need not be combined with the Bordeaux treatment for the scab. The time for this spraying for the codling moth will vary with locality and seasons. The larvae of this second generation enter the fruit beginning with the last of July and extending through August and September. The number of sprayings to be made against this second generation depends upon the efficiency of the preventive measures and of the early sprayings. Two of these later sprayings are usually sufficient, and may be made, respectively, during the last week in July and about the middle of August. The quantity of lime used in the last spraying should be reduced to not more than 1 pound to the pound of arsenical to avoid a limy coating on the ripe fruit. Light showers have but little effect in washing away the spray, but a continued rain or heavy shower may make it necessary to repeat the application.

For the convenience of orchardists and others, the materials to be used at each spraying and the times for applying the same to secure the best results have been arranged in the following form:

First application—Material, Bordeaux mixture and arsenical; time of application, after leaf buds unfold and before flower buds open.

Second application—Bordeaux mixture and arsenical; just after petals fall.

Third application—Bordeaux mixture and arsenical; 15 days later (this may be omitted in dry seasons, and in dry states like Nebraska).

Fourth application—Half-strength Bordeaux mixture and full-strength arsenical; 30 days after petals fall.

Fifth application—Half-strength Bordeaux mixture and full-strength arsenical; 60 days after petals fall (optional).

Sixth application—Arsenical; July 25.

Seventh application—Arsenical; August 15.

USE OF INSECTICIDES TO PREVENT WORMY APPLES

BY A. L. MELANDER, WASHINGTON EXPERIMENT STATION, PULLMAN. BULLETIN 68.

THE worm of the first brood is hatched from a tiny flat egg laid by the mother on or near the young apple, hatching two or three weeks after the trees have blossomed. As soon as it hatches it seeks about for a shelter. This is provided by the calyx or blossom end of the apple, into which it crawls. Thereupon it proceeds to burrow into the apple, feeding as it goes.

After remaining in the apple until grown—the time depending on the locality, but ranging on the average from two to four weeks—the worm emerges and seeks another and a different hiding place. Instinct prompts it to descend, and normally its course is down the trunk of the tree. However, if the branches are overweighted and low, the worm lowers itself by a silken thread, spun from the mouth. It now crawls about until it finds a suitable place for concealment, wherein it spins a cocoon of silk. Cocoons are made under the bands, loose bark, rubbish, or in the ground.

Mosier Valley Apple Orchard in Bloom

The Pupae

After the summer worm has prepared its cocoon it pupates within it. That is, it changes to the brownish, glossy, legless "worm." In this condition it rests a little over two weeks, when it is transformed to the moth or miller, which is the codling moth of the second brood. The total life period of the first brood is approximately from one to three months.

The Second Brood

By the time these moths have appeared apples have become fairly large. The eggs of the second brood are laid on the apples. When the minute worms hatch they try to burrow through the apple skin, but as their jaws are weak they need something to prop their bodies against. That is why apples wormy by this brood have the worm holes where two apples touch.

Is There a Third Brood?

Because in the warm river valleys many apples become wormy in September and October a third brood even is suspected, but there is as yet no positive evidence that these late worms belong to a third brood rather than that they are belated individuals of the second.

How the Winter is Passed

When the worms of the second generation have reached maturity, having fed eighteen to thirty days within the apple, the time depending on the temperature and season, they too descend the tree and cocoon. These late worms do not pupate, but instead remain over winter as larvae within their cocoons. In the spring they pupate and later change to moths a few days after apple trees have blossomed.

The Codling Moth Calendar

We may summarize the time that the insect remains in each of its stages as follows:

	Minimum days	*Average days*	*Maximum days*
Winter larva	240	..	295
Spring pupa	21	29	36
Moth	2	4	10
Incubation period of egg	8	10	18
Worms in apples	12	20	30
Worms in cocoon until pupation	..	7	..
Pupa	..	16	..
Total life of summer insect	35	57	100

It is because of these variations in the rapidity of development of different individuals that spraying for the codling moth is a problem. If all codling moths were actuated alike so that all entered the apple at a set time determined by the climate, there would be no difficulty in keeping this insect in check.

Why Spraying is Necessary

A female codling moth lays on the average from forty to fifty eggs. Therefore, each pair of moths surviving the winter become the parents of twenty sons and twenty daughters. As two broods of moths prevail over the greater part of the state, the twenty daughters are responsible by the end of the season for eight hundred grandsons and granddaughters.

In an old orchard the number of wormy apples remains about the same from year to year. That is to say, of the eight hundred worms of the second brood only two survive the winter. In other words, natural conditions tend to keep the codling moth in check.

But when the codling moth makes its appearance in a new locality it has no natural enemies, and a larger proportion of worms survive. Therefore the codling moth is capable of ruining a crop of fruit at any time when conditions are favorable for its survival, even though the season before but a small percentage of worms could be found. For this reason new orchards especially should receive careful attention lest the codling moth gain a foothold.

How the Codling Moth is Spread

The codling moth is spread mainly through the shipment of wormy fruit. Orchards nearest packing houses are most liable to infestation. Old, outstanding, abandoned trees are often responsible for thousands of moths. The adult moths are capable of flying a mile or so. Do not let the orchard get overrun with worms by inattention to one year's spraying. Experience shows that in general the pest is more difficult to subdue when numerous.

When to Spray for First Brood.

The object of spraying is to coat the food of the newly hatched worm with poison, so that its first meal will be its last also. Inasmuch as the worms of first brood attack the apple generally at the calyx end, it is the aim of the first spraying to place the poison there. This is best effected after the blossoms have fallen, but before the calyx cup has closed. But as the blossoms of the apple fall about two weeks before the majority of the worms enter the apple, it is necessary to spray a second time two weeks after the first treatment. These two sprayings constitute the campaign against the first brood. If injury by the first brood now amounts to more than two per cent the campaign must be extended to second brood.

Spray for Second Brood

The time for spraying for the second brood can be determined by the use of a breeding jar. This is simply a Mason fruit jar with a cover of cloth tied over the top. In this jar are placed some cocoons of the first brood taken from the tree-trunk. In due course these cocoons will liberate codling moths and the precise time for spraying in that locality is determined for that season. The spraying should be done about a week after the moths appear to allow for the incubation period of the egg. Many fruit growers spray a fourth time two weeks later, and if many apples become wormy in September a fifth spraying even is given. Spraying every two weeks will be seen to be unnecessary. It is not how many times you spray that counts, but how well you do it at the proper time.

What to Spray With

Paris green is almost universally used against the codling worms. This is mixed with lime to prevent scalding the foliage. The formula for apple and pear trees stands:

Paris green, pounds	1
Lime, pounds	1 to 2
Water, gallons	150

In an arid climate but little lime is necessary. Many fruit growers use more lime. Too much lime hinders the action of the Paris green. The mixture should be well agitated while spraying to keep the liquid uniform.

Arsenic, lime, and soda is equally effective and costs one-third as much. Its formula is:

White arsenic, pounds	¼
Washing soda, pounds	1
Water, quarts	1

Dissolve by boiling. Add to 100 gallons of water and eight pounds of freshly slacked lime.

A small orchard should have a hand pump outfit, costing from $15 to $75. A large orchard should possess a gasoline

power pump, costing $275 at the outset, but saving two-thirds in the running expenses. In general, the Bordeaux-type of nozzle, throwing a fan-shaped spray is used in the first spraying as it fills the calyx cup more forcibly. Spray from a height down into the flower at this spraying. Later sprayings are done with a cyclone-type of nozzle, which throws a cone-shaped misty spray, covering the fruit and leaves. A grave danger here is over-spraying, i. e., causing the liquid to gather in drops instead of depositing a uniform sediment. Over-sprayed apples are not thoroughly poisoned.

The only way to decide on the value of spraying is to leave certain trees in the orchard unsprayed as "check trees." When this is done in an infested orchard it is found that the injury to properly sprayed trees generally can be kept below 10 per cent and most frequently below 5 per cent, whereas the check trees have practically the entire crop ruined. The past season the injury to unsprayed trees in the Yakima Valley averaged above 80 per cent, whereas sprayed orchards yielded 90 per cent and more of sound fruit. It is useless to expect good results from spraying if the trees are much closer together than thirty feet and are badly trimmed.

Mr. R., near Colfax, sprayed fourteen acres four times at a cost of $40, or one cent per tree each spraying; 15 per cent of his apples became wormy. His neighbor, Mr. W., growing the same varieties, sprayed once, carelessly. All his fruit became wormy, with several worms to the apple. This is an average.

Banding.

Banding consists of fastening a strip of burlap eight inches wide about the trunk, firmly below and loosely above. This is done conveniently by fastening one lower corner of the strip over a small finishing nail driven partly into the tree. The band is then wound tightly around the trunk fastening the other lower corner over the nail also. This allows easy removal of the bands. The object of banding is to trap the worms. When the worms descends the tree on reaching full growth, it pupates within the provided shelter, and is accordingly easily reached and killed. Worms stay under the bands at least sixteen days during the summer. Therefore unless the bands are inspected every sixteen days during the warmer part of summer, they merely assist the worms in their transformations.

If the spraying is thorough it is unnecessary to band, because almost none of the worms escape poisoning. Bands are useful in new orchards where spraying has not yet been instituted. In badly infested orchards bands accomplish no good. The bands trap about 40 per cent of the worms.

Orchard Practices.

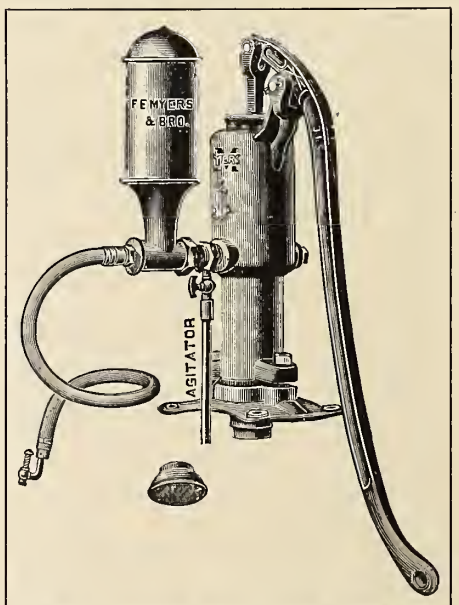
Thin clusters of apples to one fruit while the majority of the first brood are still within the apple (about the middle of June), and bury the infested fruit. If the wormy apples are not thinned they will drop off anyway after the worms are through with them. The more of the first generation destroyed the less of the second there will be to make the apples wormy.

Keep the orchard clean. Rubbish assists the codling moth in its transformations. The more the worms in the ground are disturbed by cultivation, the less chance they have of surviving. Scrape loose bark from the trees to deprive the worms of a safe cocooning place. Birds and chickens, ants and other insects, hogs, moisture, cold, hot sunshine, and sickness kill many worms. Especially should birds be protected as the benefit derived from them is great.

Vegetables Raised at Irrigon, Oregon

Quack Remedies

It is impracticable to inoculate trees so to kill the codling worm. The adult moth is not attracted to light, cider, molasses or vinegar. Moth balls, tar paper or ill-smelling smudges have at most but a temporary effect, and are not economical.



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Failures

Like other farming operations, spraying does not give invariable success. If improperly carried on good results can not be expected. The main causes of failure, however, are:

(a) Heavy rains soon after spraying. If so, spray again.

(b) Much wind, causing apples to rub off their coating.

(c) Not enough applications.

(d) Spraying done at wrong time.

(e) Solution not well mixed, the first spraying too weak and the last too strong from one tank-full.

(f) Too much lime, spoiling the good effect of Paris green.

(g) Imperfect work, the apples only partly coated.

(h) Overspraying, so that the spray gathers in drops and runs off.

Are Sprayed Apples Poisonous?

An average tree receives about a fourth of an ounce of poison during the course of a spraying, an average apple about one two-hundredth of a grain. Therefore, at least 400 freshly sprayed apples, skins, stems and cores, must be eaten at one sitting in order to receive the minimum poisonous dose.

Does it Pay to Try?

Some fruit growers are prejudiced against spraying methods. Either they have never tried and are afraid to begin, or else they have done it faultily. Often they become discouraged at their outlook and cut down the orchard. If not cut down the orchard is abandoned, and the breeding moths contaminate the neighborhood.

To demolish the orchard because it is wormy is to kill the goose laying golden eggs because her eggs are inedible. The codling moth is not inevitable. It is not obligatory to submit to it. It is not fate.

Many orchardists will not spray because it is too costly. Let us look at some figures of actual conditions. An apple tree capable of yielding ten boxes of fruit has ten per cent of wormy apples when sprayed. If unsprayed during the season eighty per cent would have become wormy. The actual cost of spraying such trees by hand power amounts to about three cents per tree, including cost of labor and all. A box of good fruit sells for 50 cents or more.

Note—Oregon, Washington, Idaho and Colorado apples sold in 1906 from 75c per box (bushel) to $3.15 for fancy.

ADS. are read in "Better Fruit" because the paper is handsome and the ads. typographically attractive. We principally use Caslon Old Style type, which is new and the latest.

EFFECT OF SPRAYING ON THE CODLING MOTH

READ BEFORE H. R. A. G. A. BY E. H. SHEPARD, EDITOR OF "BETTER FRUIT"

I WISH to say, gentlemen, that I do not claim this to be an entirely original talk, but on the other hand it is more a collaboration principally from Simpson, Milander, Cordley and Ball. In nearly every instance their words best express the idea. Furthermore, I wish to state that I do not consider myself well enough informed to advise you, nor do I wish to persuade you to adopt any of these methods. I am simply going to tell you, as I remember them, the opinions, observations and conclusions of intelligent workers on the codling moth that you may have an opportunity to discuss and consider them. If I have erred in any particular or omitted any important feature, there are many experienced growers present who are better posted than I and with better memories, and I beg of them to correct me lest harm be done.

Again, I wish to preface my remarks by saying I do not purpose to give you information founded solely on my own experience. I have read everything obtainable on the subject and have been in attendance at all our horticultural meetings for the last three years. In evidence of the value of what I have learned I wish simply to state that of the 2500 trees on my place but 100 are bearing. In 1903 I had $18.50 worth of good apples; in 1904, $386; in 1905, $800, and of the 400 boxes this year there were only nineteen boxes less than four tier and no five tier, and only 5½ per cent loss from all causes.

Stages

The life of the codling moth is divided into four different stages, the egg, the worm, the pupa, and the moth. The codling moth passes the winter in the larvae stage, found in silken cocoons on the bark of trees and in various places. If you have an apple house in which there were wormy apples do not fail to spray it. In spring hibernation these larvae change to pupae from which the moth emerges about blossoming time, Simpson says about a week after the apple tree blossoms. The moth with wings extended is about three-fourths of an inch across, of a grayish brown color similar to the bark of the tree.

The moth lays her eggs in about four days after she emerges, and, by the way, she lays fifty of them. The eggs of the first brood are generally conceded by the best authorities to be laid on the leaves, while most of the eggs of the second brood are laid on the apples. The egg is nearly white, about the size of a pin head. In about ten days the egg hatches into the worm, which seeks a place to enter the apple. The worm or larvae is about one-sixteenth to one-twentieth of an inch long when hatched, and this is the fellow we are after. The worm feeds on the apple about twenty days, and when he emerges, usually from the side, he seeks a place to spin the cocoon, frequently the bark of the tree or some dark place. The larvae of worms change into pupae in about six days, and in about twenty days emerge again as moths to lay the eggs of the second brood.

For a more thorough knowledge along this line I refer you to Farmers' Bulletin No. 171, which can be secured of the Department of Agriculture at Washington free of charge. "The Codling Moth," by C. B. Simpson, Division of Entomology, Department of Agriculture, Washington, D. C., which can be secured for fifty cents, or the Biennial Report of State Board of Horticulture; of which the Hon. E. L. Smith is president and of whom a copy can be obtained by asking for it. And, by the way, nearly every subject discussed here today is ably treated in this report, and if you have it not, let me suggest that it is your duty to yourself as well as your neighbor to get it and study it.

The Irrigon Nursery

The duration of each stage of the codling moth is as follows:

	Melander			Simpson
Days:	max.	min.	av.	av.
Winter larvae	240	..	295	..
Spring larvae	21	36	29	..
Moth	2	10	4	5
Incubation of egg	8	18	10	11
Worm in apple	12	30	20	20
Worm in cocoon until pupation			7	22
Pupae			16	..
Total life of summer insect			57	58

A complete metamorphosis, that is from moth back to moth again, is from fifty to fifty-seven, a great many claiming fifty days average in summer. So about fifty days after the first moths appear watch out for the second and get your spraying done in time for the worms, which will begin to chew in from ten to sixteen days.

Material

I think all those present who used Swift's arsenate of lead last year feel sufficiently satisfied to be justified in using it again. The fruit growers of Pajaro Valley, under direction of the Experiment Station of California, spent $35,000 to find a better spray than Paris green and one that would not burn their foliage. Although they tried every known spray they found that Swift's arsenate of lead gave the best satisfaction. Colorado also had good success. In fact, I have yet to hear of a grower who used it that is dissatisfied. If there is any one who is opposed to it let him speak out and give his objections when I have finished. Hood River used about one-half pound of arsenate of lead for each tree for the season. Swift's directions are for the first spray two and one-half to three pounds for fifty gallons; for the second, two to two and one-half pounds; for the third, one and one-half to two pounds, and the following sprays one to one and a half pounds for fifty gallons of water.

Now I am up against the real thing: when and how to spray. As Prof. E. D. Ball, of the Experiment Station, Logan, Utah, has spent seven years on this work, I am going to tell you what he said, because he has given the best talk, backed up by statistics, that I have ever heard. First let me tell you he selected the wormiest orchard in Utah, and made his comparisons on the same number of apples on a tree, because comparisons must be made under similar conditions. Prof. Ball said substantially as follows: In Utah unsprayed orchards have averaged a worm to each apple. Many problems remain to be solved before we can say with certainty just what is the best method of controlling the codling moth under the varied conditions in which it is found.

The Utah station concerned itself with three questions:

First, what is the relative value of early and late sprays?

Second, what is the relative of each of these early sprays?

Third, how long does the value of the early sprays last, or in other words, do the early sprays kill any worms in the second brood?

In order to get these exact results every apple that set on a tree was counted and examined. In this experiment this was done on sixty-four trees averaging 3500 apples each. For this work it was also necessary to separate the damage of the first brood of worms from the second, which was done by counting every wormy apple on the trees just before the second brood began its work. Three early sprays were tested by varying the order of the sprays in six different ways as the following remarks will show. The first spray was applied just before the blossoms had fallen, the second ten days later, and the third fifteen days after that.

Results of First Brood

Trees that had only the third spray were as wormy as the unsprayed trees. Trees that had only the second spray had seventy-nine per cent of worms killed. Trees that had only the first spray had eight wormy apples, or eighty-nine per cent of worms killed. Trees that had the first two sprays had four

wormy apples, or ninety-four per cent of worms killed. Trees with three sprays had only three wormy apples, or ninety-six per cent of worms killed. These results are shown in the following table:

Times sprayed	000	001	010	100	110	111
Wormy apples ...	72	..	15	8	4	3
Worms killed	0	..	57	64	68	69
Per cent killed ...	0	..	79	89	94	96

From these results we see that the third spray alone was of little value. The second spray alone killed almost four-fifths of the worms. The first spray alone killed eight-ninths of the worms. Both are valuable, the first is double the value of the second when applied alone, but the first and second when both were applied killed seventeen-eighteenths of the worms, or 94 per cent of the first brood. When three sprays were applied a slightly better result was obtained.

Where Worms Were Killed

Examination showed, where the second spray was applied, that of the fifteen wormy apples only five were wormy in the calyx; where the first spray only was applied, of the eight wormy apples but one was wormy in the calyx; where the first and second sprays were applied, of the four wormy apples only three-fifths of an apple was wormy in the calyx. In consequence it is seen that by these early sprays the calyx worms are practically exterminated and that but few worms escape, and these go into the side.

Results in Second Brood

Times sprayed	000	001	010	100	110	111
Wormy apples ...	216	..	120	78	48	48
Worms killed	0	0	96	138	168	168
Per cent killed ...	0	0	44	64	78	78

From these results we see that the third early spray was of no value in the second brood; the second one alone killed nearly half the worms; the first one alone killed one-third more than the second alone, and the first two together killed three-fourths of the worms in the second brood.

Hard to Believe

It is hard to believe that a spray properly put on at the right time in May (in Utah) could kill over half the worms entering the apples in August and September, or that the two early sprays applied properly at the right time before June 10th (in Utah) could kill over three-fourths of those same worms. The results were so uniform for two consecutive years that there could be no question about their accuracy. My further investigation and explanation makes the matter clear.

Poison in Calyx Cup

The poison put in the calyx cup in the early sprays remains there. You can see this and convince yourself by examination with a microscope and this is responsible for the greater part of the results. Taking the actual figures there was an average of 101 calyx wormy apples on the unsprayed trees from the second brood; forty-one where the second spray only was applied; eight where the first spray was only applied, and only three where the first two sprays were applied. From these figures you see that the poison in the calyx cup, where the first and second early sprays were applied, killed ninety-eight of the 101 worms of the second brood entering the calyx from August 1st in Utah until packing time. Besides killing ninety-seven per cent of all the worms of the second brood entering the calyx, the early sprays killed seventy out of 115 worms that went in on the sides, or sixty-one per cent of the worms of the second brood entering the side. These statements have all been given in actual number of worms found, which is the only true way to compare results. Translating them into per cent means that the second year these two early sprays gave ninety-eight per cent of sound apples.

The Main Canal at Irrigon, Eight Miles from the Dam

Methods Used

The essential feature of the work was forcing the small drops of poisoned liquid between the stamens way down into the bottom of the calyx cup. To do this is necessary to have eighty-five to 100 pounds pressure and the spray must be thrown in fine drops that do not break into a mist within six feet of the nozzle. Then by using a platform so the operator is on a level with the top of the tree, and extension pole with a nozzle set at an angle of thirty degrees, each part of the tree can be sprayed so the liquid will be forced straight into the calyx cup.

In conclusion, Professor Ball said he was not offering a method for spraying in humid regions, as he was not familiar with them; that he was not advocating Paris green as better than any other poison and that it is not better, but he used it because he could see it better, and in an arid region it is safe. Neither did he advocate two sprayings or any other number; but what he did advocate was that the early sprays be applied according to the method he gave, and if it was done he believed we would be able to get on with a less number of late sprays, and under favorable conditions possibly without any late sprays for the second brood.

First Brood

The first two sprays are the most important and if applied properly at the right time kill by far the greater number of worms. Ball applies the first spray just after the blossoms have fallen, but in Hood River we applied last year just before all the blossoms had fallen. It remains to be determined which time is preferable. It is possible that by applying just before may necessitate a third early spray, which was customary here last year, but which Ball stated was of little value in the arid region when the first spray was applied just after the blossoms had fallen. While we all are sure that two early sprays are sufficient with us, actual work has proven that three early sprays get results. The second early spray should follow the first within ten days, and the third, if applied, within thirteen days after the second. These early sprays are applied in advance of the first brood.

Second Brood

The proper time to spray for the second brood, which by the way is large in Hood River, would naturally be a few days in advance of about fifty days after the entrance of the first worms, but it is not best to figure by days, as the temperature varies the cycle period. The better way is to determine by brooding cages or counting the worms under the bands. If you use the brooding cage take a fruit jar, put in some cocoons, cover the top with mosquito netting and place out of doors. When the moth appears in the jar your spraying should be done in about a week and surely within thirteen days. Let me caution you to be sure you get early cocoons. If you determine by counting the worms under the bands, spray in thirteen days after you observe the greatest number. The second spray for the second brood should follow in thirteen days, and Ball says in Utah the third spray for the second brood should follow in thirteen days again. I am rather of the opinion that two sprays would be sufficient for the second brood, for the reason that the maximum period of the life of the moth and incubation of the egg combined is twenty-eight days, which exceeds the minimum period of ten days by eighteen days, therefore if we get the first spray for the second brood on at the proper time and follow with another in thirteen days we have kept the apples continually coated for twenty-six days, which will kill maximum stragglers, as they are eighteen days

behind the first worms of the second brood. Let us look into this by actual dates.

Full blossoming time is about May 10th. In about ten days, just before the blossoms have fallen or about May 20th, we apply the first spray. The majority of worms enter in about fifteen days after blossoms have fallen, which would be about June 5th. The first spray for the second brood, which by this plan would be your fourth spray, probably would be in advance of fifty days from June 5th, which means with us about July 25th, followed with another spray in thirteen days, which would go on about August 8th and keep the apples covered until about August 22nd. I want to tell you about actual work by Chris Dethman and compare it with the above. He sprayed last year just before the blossoms fell; the second time ten days later and the third time two weeks after that. He then waited forty days and sprayed the fourth time, and in two weeks sprayed again, and he had a fine clean crop of apples. Now assuming that spraying just before blossoms fell with him was the same date as we assume in our calculations, May 20, his second spray would be June 1st, his third June 14th, and forty days later for the fourth spray would be July 24th and his fifth spray August 8th. You see they both agree.

A Two Year Old Vineyard at Irrigon

Now if there is a third brood the time to spray for it would be determined by jars or bands, or calculating approximately by dates would be about fifty days from the first spraying for the second brood, which we put about July 25th; this would mean about September 10th to 15th, which would be your sixth spraying. I am inclined to believe it advisable, because we all remember great damage in the early part of September.

In spraying for the first brood do not use a mist nozzle but one that throws a fine stream, as the object is to force the poison way down into the calyx, and a fine stream and force is necessary to put it there. In spraying for later broods use a mist nozzle as the object is to coat the apple. A Y nozzle is the best at all times.

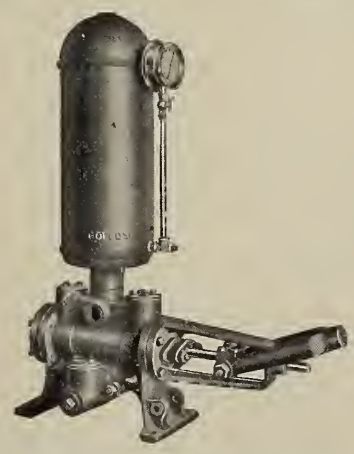
Be careful in spraying not to get too much drip, as drops in forming are apt to pull the poison together leaving the surface of the apple bare in spots, but be sure your apples are coated.

Don't neglect to band your trees, and examine the bands each week and kill the worms, and the nearer the color of the bark the band is the better. Every moth killed means the saving of twenty-five apples from being wormy or stung, that means a quarter of a box more clean apples, at $2 per box worth fifty cents. At a cost of $3 I killed under the bands an average of four worms on 100 trees, which meant the destruction of 10,000 eggs, the saving of 10,000 apples from being wormy or stung, or 100 boxes at $2 per box and that meant to me $200 in coin.

Lastly, it is not the number of times you spray that does the work, but how and when.

Thinning: How and When to Do It

I want to call your attention in connection with this subject to thinning. The favorite place for worms entering the side of the apple, is some defective spot like scab or limb rub, therefore, pull off the imperfect apples when you thin for two reasons, because they will be cultus and because you remove a favorite entrance place of the worm. Also in thinning cull off one of two apples that are in contact with each other, because if you leave them one or both will surely be wormy. It is also advisable to pull off one because both will not be apt to develop into perfect apples. A little observation, experience and training of the eye will enable you to detect in advance which one will grow to be a fine apple, and which one a runt. If you don't believe this leave a few pairs of apples to convince yourself. In both cases you remove a favorite entrance for the worm, and he is the more likely to try the calyx, where you have the poison sure, that will kill him if your early sprayings were properly done at the right time.



Gould's Vice-Admiral Double Acting Sprayer. Horizontal Cylinder, for connection to Gasoline Engine. Portland Seed Co., Portland, Oregon, Agents

In many localities there is twenty-five per cent of the first brood entering the sides, as we have no data here it seems to me that until we have proof that the first brood do not enter the sides it would be advisable not to dispense with the third early spray, as this will coat your young apples with the spray and protect them from side worms.

You should thin your apples early because you do not wish an apple to take up a lot of strength from the tree and then pull it off. In thinning put your apples in a barley sack which you can hang around your neck. Be sure to get all the wormy apples in your sack, take a spade along with you and when you get a load, dig a hole in the ground and bury the apples six inches to a foot and that will end the worms, and every worm you kill this way destroys in advance twenty-five worms of the next brood.

If your trees are old and the bark rough take a hoe, cut off the handle to a convenient length and scrape the bark. This will remove many places where the worms can spin their cocoons and the worm will probably go under your bands where you can find him and kill him and thus head off another bunch of twenty-five worms in the next brood. Pruning is also closely related to the subject. In the first place you should remove surplus sucker and wood growth and let the light into the tree so your apples will mature well and get color. If you do this pruning right you will find it much easier to thoroughly and properly spray a tree.

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READ "Better Fruit," grow better fruit, get better prices, and watch "Better Fruit" grow.

FUNGICIDES FOR PREVENTING FRUIT DISEASES

BY M. B. WAITE

THE object of this bulletin is to give the principal formulas for fungicides, together with a brief description of their method of preparation and a summary of the principal diseases of fruits for which satisfactory remedies have been found. Most, though not all, of these remedies consist of spraying. All of the materials can be purchased at most drug stores or from agricultural supply houses. The spray pumps can be obtained from implement dealers or direct from the manufacturers. By consulting agricultural and horticultural papers numerous advertisements of these pumps may be found.

The outline for treatment presupposes a knowledge of the name of the disease and no extended descriptions are given. Unless the reader is familar with the name and character of the disease he should send a specimen to some plant pathologist for identification. Specimens of diseased fruits or leaves or other portions of plants may be forwarded to any State experiment station or to the United States Department of Agriculture, where a careful microscopical examination will be made and the disease identified. As most of the treatments by spraying are preventive and have to be made some days or often weeks before the disease appears, it is well to make this study of the diseases during the fruiting season, have the specimens examined at that time, and plan for the treatment the coming season.

FUNGICIDES AND THEIR PREPARATION

Copper Compounds

Formulas for Bordeaux Mixture

The most valuable fungicide for use in combating plant diseases is Bordeaux mixture, consisting of a mixture of copper sulphate (bluestone) and stone lime slacked in water. The formula varies somewhat according to the use which is to be made of the spray. Following are the ones most used:

Standard Bordeaux Mixture—The following formula, known as the 6—4—50 formula, the ingredients being mentioned always in the same order, is used in the preparation of the standard Bordeaux mixture:

Copper sulphate (bluestone), pounds..	6
Lime, pounds	4
Water to make, gallons	50

This mixture can be used successfully on many plants, but on others, like the peach and Japanese plum, it injures the foliage. It also sometimes russets the fruits of apples and pears. It can be increased in strength for certain purposes by reducing the proportion of water, but the formula given above has been regarded as the standard with which all others should be compared, at least in experimental work.

The 5—5—50 Formula—Standard Bordeaux mixture is frequently slightly modified, a very common modification being made according to the formula which follows:

Copper sulphate, pounds	5
Lime, pounds	5
Water to make, gallons	50

The use of this formula is desirable where the purity of the lime is in doubt, as it makes certain, with lime of any reasonable quality, that all of the copper is properly neutralized. The danger of scorching or russeting the fruit is therefore less. Withholding 1 pound of copper sulphate also cheapens the mixture by a few cents. For these reasons the 5—5—50 formula has come to be quite generally used in orchard spraying. In fact, it has almost replaced the old standardBordeaux mixture in spraying for the apple scab, bitter rot, pear and cherry leaf-blight, and similar diseases. In the central Mississippi Valley the 4—5—20 formula has given good results, especially in dry years.

The 4—4—50 and Other Formulas—The strength is often still further reduced by using a 4—4—50 formula, but it is questionable whether it pays to reduce the strength. The same result can be secured with sprays having less copper, provided the application is thorough and repeated; but, as in actual experience the cost of applying Bordeaux mixture is often from two to five times the cost of the mixture itself, economy demands the use of the strongest mixture which will do the work without injury to the plants.

For use as a whitewash, a very concentrated mixture, 6—4—20, may be desirable; and for certain diseases Bordeaux mixture can be diluted so as to be equivalent to 6—4—100.

Peach Bordeaux Mixture—The form of Bordeaux mixture most harmless to foliage is made up by the formula 3—9—50, having a considerable excess of lime. This may be known as "peach Bordeaux mixture," and contains ingredients as follows:

Copper sulphate, pounds	3
Lime, pounds	9
Water to make, gallons	50

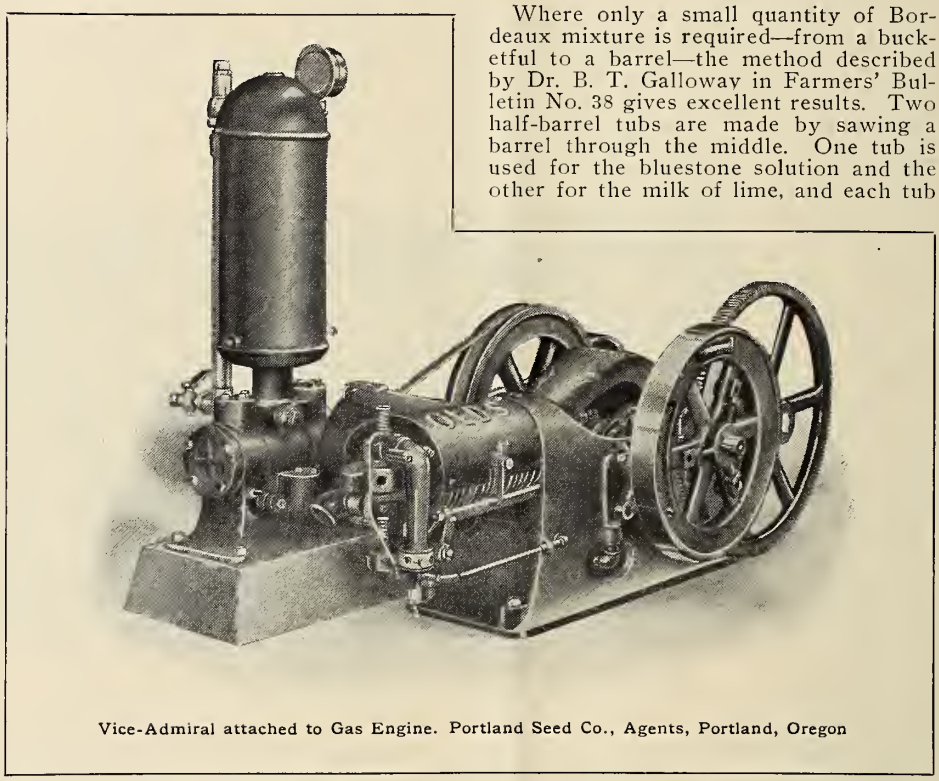
Modified Bordeaux Preparations—Various modifications of the original Bordeaux mixture have been suggested and tried. The principal ones, however, are the "soda Bordeaux mixture" and the "potash Bordeaux mixture." The former consists of 6 pounds of copper sulphate, 2 pounds of caustic soda, and 50 gallons of water. The latter is the same except that an equal quantity of caustic potash is substituted for the soda. Other materials are sometimes added to Bordeaux mixture to increase its spreading power. The most successful is ordinary hard soap, dissolved in hot water and added at the rate of 4 pounds to the barrel, and this modified Bordeaux mixture is known as "soap Bordeaux."

Method of Making Bordeaux Mixture in Small Quantities.

Where only a small quantity of Bordeaux mixture is required—from a bucketful to a barrel—the method described by Dr. B. T. Galloway in Farmers' Bulletin No. 38 gives excellent results. Two half-barrel tubs are made by sawing a barrel through the middle. One tub is used for the bluestone solution and the other for the milk of lime, and each tub should contain 23 to 25 gallons. One man dips the bluestone solution with a bucket and pours it into a barrel or other vessel, and another man simultaneously dips up and pours in bucketfuls of the milk of lime. The lime solution should be kept well stirred. If only a single barrel is to be made, the materials may be dissolved in the dilution tubs, but if a number of lots are required the materials can be kept in stock solution and simply transferred by dipping. In preparing very small quantities of Bordeaux mixture, buckets or similar vessels may be substituted for the half-barrel tubs. It is possible for a single operator to dip a bucketful of the bluestone solution and then a bucketful of milk of lime and pour them together into a vessel. It is usually preferable to have a bucketful or so of water in the receptacle into which the solutions are to be poured, but this is not essential.

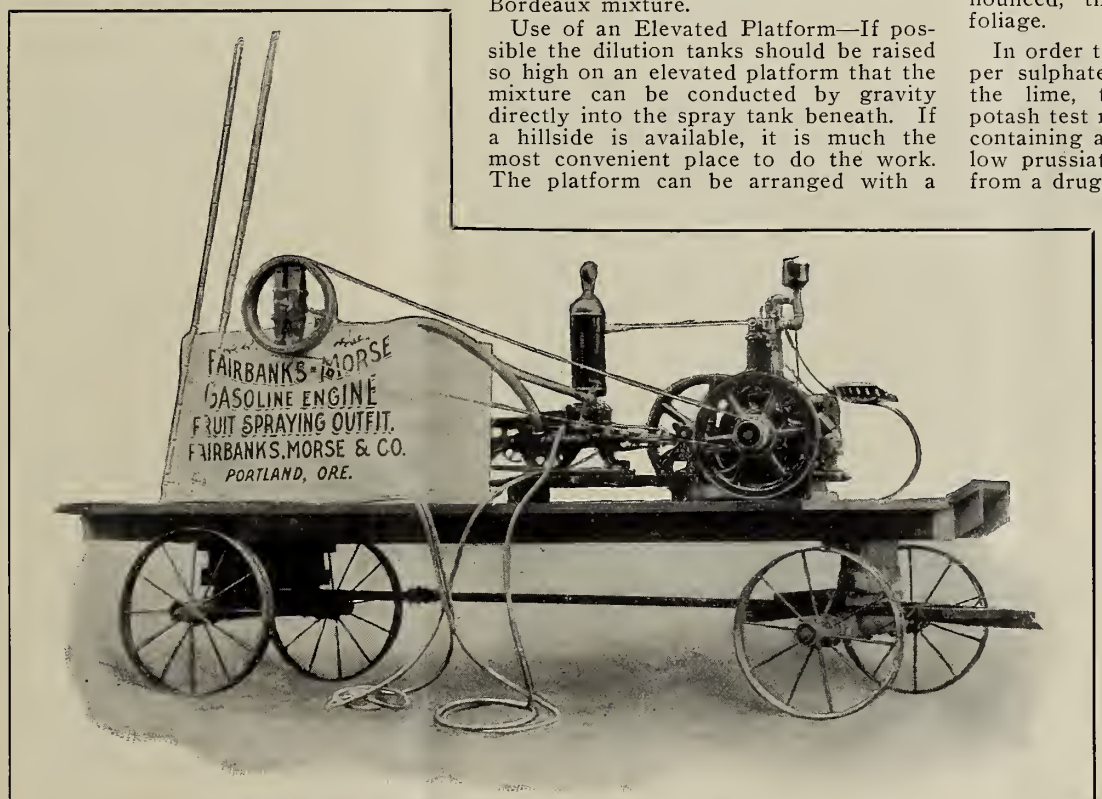
The better and quicker way of making Bordeaux mixture by the barrel consists in placing the two half-barrel tubs on an elevated platform and then, by means of hose or spigots, allowing the two solutions to flow together into a barrel. This method is more fully described farther on.

Straining the Materials—No matter what quantity of mixture is to be made up, it is necessary to strain the materials



Vice-Admiral attached to Gas Engine. Portland Seed Co., Agents, Portland, Oregon

through a wire strainer. The best type of strainer is made of brass wire, with 18 or 20 meshes to the inch. If all the copper solution is strained and then the milk of line is strained into the dilution vessels, it will not be necessary to strain the Bordeaux mixture as, on account of its flocculent character, it is sometimes more difficult to pass through the strainer than the lime milk. Some very good strainers made of copper are on the market and may be obtained from the makers of spray pumps. One of the best, which can be made at home, is in the form of a box about a foot square, the bottom of which is a rather heavy board (preferably of hard wood) with a hole bored through it, into which a piece of gas pipe 1½ to 2 inches in diameter and 8 to 12 inches long is fitted. The box is of course open at the top. Fitting just inside this box is a second and lighter box, also open at the top, and having an overhanging strip nailed around the top which supports it. The bottom of this inner box should be made so as to slope at an angle of about 30°, and should be made of wire screen. The slanting bottom makes it harder to clog with the spray, and the inner box, being movable, can be inverted and washed in a tub of water.



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Method of Preparing Bordeaux Mixture for Large Operations.

In large operations stock solutions should always be used, as the time required to dissolve the material is saved.

Stock Solutions—These can be prepared of both the copper sulphate and the lime. They may be made by dissolving copper sulphate in water at the rate of 1 pound per gallon, and lime in the same ratio, although a strength twice as great may be used in warm weather. When stock solutions are on hand it is only necessary to measure off the required quantity of each and dilute with water before mixing. In preparing a stock solution of copper sulphate, a 50-gallon barrel may be filled about two-thirds or three-fourths full of water; then a sack, or a box with perforations over which copper wire has been tacked, containing 50 pounds of bluestone, should be suspended in the upper part of the barrel and enough water added to fill the barrel. In from twenty-four to thirty-six hours this material will be entirely in solution, and the sack or box may be removed. A slight stirring will insure the even distribution of the bluestone, after which the solution is ready for use.

The copper sulphate should be measured in a copper or graniteware receptacle, iron or tin vessels being quickly destroyed by either copper sulphate or Bordeaux mixture.

Use of an Elevated Platform—If possible the dilution tanks should be raised so high on an elevated platform that the mixture can be conducted by gravity directly into the spray tank beneath. If a hillside is available, it is much the most convenient place to do the work. The platform can be arranged with a roadway on its upper side so that the lime and bluestone can be delivered there, while the spray tank is filled from the lower side.

The Water Supply—A water supply of some sort is necessary; a tank filled by a windmill pump and elevated so as to be a few feet above the dilution tanks is a great advantage. Hose may be used to fill the dilution tanks, or an iron pipe with a spigot may be placed over each tank. Each dilution tank should hold half the quantity it is desired to make up at one time—that is, if a 200-gallon spray tank is to be filled the dilution tanks must hold about 100 gallons each. There is no objection to adding a few extra gallons of water, but it is better to have the tanks hold just the right quantity.

Methods of Mixing the Solutions—Either of two methods of mixing can be employed: One in which the spray material is conducted directly from the dilution tanks into the spray tank and actually mixed in this tank; the other in which a mixing tank sits just below the dilution tanks and from which the spray, after being mixed up, is conducted by gravity into the spray tank. In certain ways the latter is more convenient than mixing directly into the tank, but unless the operations are somewhat extensive it will hardly justify the extra expense. In very large operations, however, a separate mixing tank is recommended—or perhaps even two of them side by side—so that batches of the mixture can be kept on hand for a few moments awaiting the spray wagons.

Testing Bordeaux Mixture

When Bordeaux mixture is properly prepared it is of a brilliant sky-blue color. If the lime is air-slacked or otherwise inferior in quality, resulting in a bad mixture, the preparation will have a greenish cast, and if this is very pronounced, the mixture will injure the foliage.

In order to make certain that the copper sulphate is properly neutralized by the lime, the yellowish prussiate of potash test may be used. A small bottle containing a 10 per cent solution of yellow prussiate of potash can be secured from a druggist. After stirring the Bordeaux mixture a drop of this solution is allowed to fall on the surface of the preparation. If free copper is present, the drop will immediately turn reddish-brown in color. Lime should then be added until the brown color fails to appear. If the reaction is complete, the yellow prussiate of potash solution will remain a clear yellow until it disappears in the mixture.

Adding Insectides

One advantage of Bordeaux mixture is the possibility of adding arsenicals to the preparation and thus of spraying at the same time for diseases and for the codling moth and leaf-eating insects. Paris green, at the rate of one-quarter pound to 50 gallons of Bordeaux mixture, may be considered as the standard formula for this purpose. London purple, arsenate of lead, and other arsenicals may be used in the same way. Bordeaux mixture may be considered as so much water in the formulas for this class of insecticides. As a matter of fact, the slight excess of lime in the standard mixture renders it an especially suitable medium for distributing these insecticides.

Dust Bordeaux Mixture

Formula—The formula given by Mr. W. M. Scott, of this Bureau, for dust Bordeaux mixture and the method of preparation are as follows:

Four pounds of copper sulphate in 4 gallons of water; 4 pounds of lime in 4 gallons of water; 60 pounds of slaked lime dust. Dissolve the 4 pounds of copper sulphate in 4 gallons and slake 4 gallons of lime in 4 gallons of water. When cool pour the two solutions together simultaneously into a tub. Allow the resulting precipitate to settle, decant off the liquid, pour the wet mass of material into a double flour bag, and squeeze out as much water as possible. Then spread out the dough-like mass in the sun to dry. After a day's drying it can easily be crumbled into an impalpable powder by crushing with a block of wood or even with the hand. This powder should be screened through a sieve of brass wire having at least 80 meshes to the inch and should then be thoroughly mixed with 60 pounds of slaked lime dust.

The lime dust is best prepared by slowly sprinkling a small quantity of

water over a heap of quicklime, using barely enough water to cause the lime to crumble into a dust. The heat generated will soon drive off the excess of moisture, and the dust should then be passed through a screen of 80 meshes to the inch. This powder is usually applied by means of a blower.

If desired. 4 pounds of sulphur and 1 pound of Paris green may be added to each 60 pounds of Bordeaux mixture dust.

Finely powdered copper sulphate, used with lime as a conveyer, is also sometimes applied to plants. When so employed at least 15 pounds of slacked lime dust should be used to each pound of copper sulphate, as this will make a very strong fungicide. The manufacturers of dust sprayers have on the market several ready-made mixtures. As a rule, these do not contain as much copper sulphate as is recommended in the above formula.

Value of DustSprays—The expense of handling large quantities of water in making up the liquid Bordeaux mixture has deterred many orchardists from using it. In case of certain mountain orchards, it is not practicable to haul the water up the steep hills or mountain sides, nor is it feasible to drive between the tree rows with heavy spraying tanks. There is a very urgent demand, therefore. for successful dry fungicides to be applied without the use of water, as the weight of the material handled is very much reduced. So far, however, in the treatment of apple scab, bitter-rot of the apple, pear leaf-blight, black-rot of the grape, and other fungous diseases requiring careful spraying. the dust method may be regarded as still in the experimental stage and of doubtful value. It is not to be compared with properly made Bordeaux mixture applied as a spray in the treatment of these diseases. In the treatment of the codling moth, however, better success has been obtained. and some help may be expected against fungi. Mr. Scott's formula is the result of considerable experimenting, and it is recommended as the best one to use. The writer is not able, however, to recommend dust spraying for general use. and wherever liquid spraying is practicable it should by all means be used.

Watermelons in a Peach Orchard at Irrigon

Formulas for Other Copper Solutions

Copper Sulphate Solution—The formula for copper sulphate solution is as follows:

Copper sulphate (bluestone), pounds..	3
Water, gallons	50

Dissolve the bluestone in the water in the same manner as for the preparation of Bordeaux mixture. A more dilute solution (2 pounds to 50 gallons) is sometimes used on foliage.

Caution—This solution is severely injurious to plants in foliage, and should therefore be applied only during the dormant period. Even the more dilute solution is usually injurious to leaves and flowers.

Copper Acetate Solution—The following formula is used for copper acetate solution:

Dibasic acetate of copper, ounces	6
Water, gallons	50

Copper acetate is readily soluble in water, and the solution may be effected by simply adding the salt to the water and stirring thoroughly. Its use is much the same as that of ammoniacal copper carbonate, and it is recommended for application to ripening fruit when it is desired to avoid the staining effect of Bordeaux mixture, though it is much inferior to the latter as a fungicide.

Caution—The injurious effect of acetate of copper on foliage is somewhat greater than that of Bordeaux, and to such susceptible foliage as that of the peach it should be applied sparingly, if at all.

Ammoniacal Copper Carbonate—The formula for ammoniacal copper carbonate is as follows:

Copper carbonate, ounces	5
Strong ammonia (26° Baume), pints	2 to 3
Water to make, gallons	50

Dilute the ammonia with about two gallons of water, as it has been found (Penny, Del. Exp. Sta., Bul. 22) that ammonia diluted seven or eight times is a greater solvent for copper carbonate than the concentrated liquid. Add water to the carbonate to make a thin paste, pour on about half of the diluted ammonia and stir vigorously for several minutes; allow it to settle and pour off the solution, leaving the undissolved salt behind. Repeat this operation, using small portions of the remaining ammonia water until all the carbonate is dissolved, being careful to use no more ammonia than is necessary to complete the solution. Then, after adding the remainder of the required quantity of water, the solution is ready for application.

Ammoniacal copper carbonate is a clear, light-blue solution, which upon drying leaves little or no stain. As a fungicide it is inferior to Bordeaux mixture, and should be used only as a substitute for the latter when the stain of Bordeaux mixture upon ornamental plants and maturing fruits is objectionable.

Caution—Plants likely to be injured by Bordeaux mixture are susceptible to more

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severe injury from applications of ammoniacal copper carbonate. This solution should therefore be applied to such plants with caution, if at all.

Eau Celeste (Modified)—The following formula is used for a solution of eau celeste:

Copper sulphate, pounds	4
Ammonia, pints	3
Sal soda, pounds	5
Water to make, gallons	45

Dissolve the copper sulphate in 10 or 12 gallons of water, add the ammonia, and dilute to 45 gallons; then add the sal soda and stir until dissolved. Eau celeste is an effective dormant spray for the peach leaf-curl and other similar diseases, but it is unsafe to use on the foliage of most plants.

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Caution—This wash should not be used on the foliage of stone fruits, and should be applied to other growing plants only with due caution.

Sulphur and Other Fungicides

Lime-Sulphur-Salt Wash

The fungicide called lime-sulphur-salt wash is made up as follows:

Lime, unslaked, pounds	20
Sulphur (flour or flowers), pounds	15
Salt, pounds	10
Water to make, gallons	50

Many different formulas are used in making up this wash, all apparently good and giving almost the same result when not too dilute. The above formula seems to be the best, and has been extensively used. If the lime is high-grade stone lime, 15 pounds will be sufficient to dissolve all the sulphur. With average lime 20 pounds is the better quantity, but with poor or partly air-slacked lime 25 to 30 pounds are necessary. Lime absorbs an equal weight of water in becoming air slaked. The writer has used partly air-slaked lime with good results, but in weighing out the lime the water in air-slaked lime must be taken into account and a larger quantity used.

Preparation in Small Quantities—Place about 10 gallons of water in an iron kettle over a fire, make the sulphur into a paste with a little water, and when the boiling point is nearly reached add the fresh lime and the sulphur together. The mixture should be constantly stirred and the boiling continued for forty to sixty minutes. The object of the cooking is to dissolve the sulphur, and when this is accomplished further boiling is useless but not harmful.

The salt may be added at any time during the process of boiling or entirely omitted. It is generally conceded, however, that salt increases the adhesiveness of the wash as it does ordinary lime whitewash, and for this reason it is perhaps advisable to use it, although it is not supposed to strengthen the fungicidal property of the mixture. Possibly, also, the salt hastens the solution of the sulphur by raising the boiling point or by its solvent action.

It has been found that the sulphur dissolves more readily in a concentrated mixture with lime, and the quantity of water used during the process of boiling should, therefore, be reduced to a minimum. The mixture should not be allowed to become pasty, however, and water, preferably hot, should gradually be added till the barrel is nearly full when finished. When the cooking is completed pass the mixture through an iron wire strainer (not brass or copper) and dilute with the required amount of water.

The wash may be applied either hot or cold with practically the same results, though the warm mixture is less likely to clog the nozzles. If allowed to stand over night, sulphur crystals will form on the bottom and sides of the containing vessel, necessitating reheating or straining before application. It is difficult to dissolve the lime-sulphur crystals after they have once formed. For this reason it is better not to prepare more of the mixture than can be used the same day.

Preparation in Large Quantities—The lime-sulphur-salt wash requires so much work in boiling and mixing that it affords an opportunity for ingenious arrangements of outfits and plants. Where only a few barrels of the mixture are to be made—say for not more than a few hundred trees—boiling in a kettle, or hog-scalder, or feed-cooker, will answer very well. In fact, quite extensive spraying operations are carried on in California by the use of a battery of iron kettles set in brick furnaces and fired with prunings and dead wood from the orchards.

The most economical and convenient way is to prepare a steam plant with tanks or barrels for boiling the spray by steam. Several different forms are in use. Some of the first very successful steam plants consisted of elevated wooden tanks, with pipes running around inside at the bottom for conducting the steam. The outfit especially recommended by the writer, however, involves the use of steam pipes by which steam is conducted into the barrel and liberated among the contents.

A 50-gallon barrel makes a very convenient unit for even the most extensive operations. Mr. J. H. Hale, of Connecticut and Georgia, has three of these outfits in use; two with 10 barrels each, and

one in Georgia of 20 barrels capacity. The steam pipe from the boiler should be of the same size as the outlet of the boiler. The two branches should be somewhat smaller in size, but should have the same total capacity. The vertical pipes should be three-fourths of an inch or slightly less. The perforations may be one-eighth of an inch or even as small as one-sixteenth of an inch in size. Steam is conducted directly into the liquid, escaping through the perforations. The water-supply pipe extends on to the platform alongside the barrels, having a branch running into each barrel. This pipe should be about 1½ to 2 inches in diameter, and the arrangement of the valves should be such that fresh water can be turned into the outlet pipe, which extends over the end of the platform and turns downward a foot or so. It has 3 or 4 feet of hose to lead the liquid into the tank, which is driven underneath.

In making lime-sulphur-salt spray the residues should be carefully watched. If yellow sulphur remains in the barrel, more lime is needed in the mixture. If a residue of both lime and sulphur remains, longer boiling should be given. Only the sand and bits of rock or other impurities in the lime should remain.

Sulphur and Resin Solution

The mixture known as sulphur and resin (sar) solution is made up as follows:

Sulphur (flowers or flour), pounds...	16
Resin (finely powdered), pounds.....	½
Caustic soda (powdered), pounds	10
Water to make, gallons	6

Place the sulphur and resin, thoroughly mixed, in a barrel or smaller vessel and make a thick paste by the addition of about 3 quarts of water. Then stir in the caustic soda. After several minutes the mass will boil violently, turning a reddish brown, and should be stirred thoroughly.

After boiling has ceased add about 2 gallons of water and pour off the liquid into another vessel and add to it sufficient water to make 6 gallons. This form of stock solution may be used at the rate of 1 gallon to 50 of water for spraying most plants and for soaking seeds.

Potassium Sulphid

For a fungicide of potassium sulphid the following formula may be used:

Potassium sulphid (liver of sulphur), ounce	1
Water, gallons	3

Dissolve the liver of sulphur in the required amount of water and use immediately. On standing the mixture deteriorates rapidly. It is effective for surface mildews, such as gooseberry mildew.

Sulphur

Sulphur is used as a fungicide in a pure state. It is on the market in a number of different commercial grades. The "flowers" of sulphur is the lightest and usually the purest chemically. The "flour" of sulphur, while finely divided, is not so light. It is sold in different degrees of fineness and purity. Stick sulphur is the same material in a solid stick.

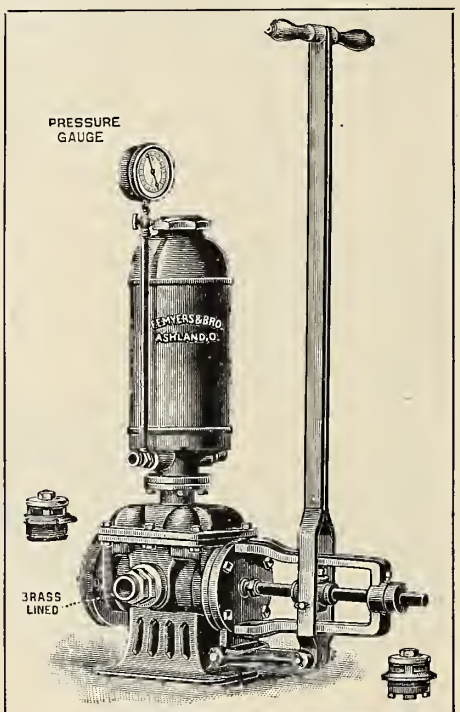
Flowers of sulphur dusted on plants is useful as a remedy for mildew, especially the rose mildew and the powdery grape mildew.

The heating pipes of greenhouses are frequently painted with flour of sulphur made into a paste with water for the production of fumes, which act to prevent various diseases. Fumes from burning sulphur may be used to disinfect empty greenhouses, storage houses, and outbuildings.

Caution—Fumes from burning sulphur are destructive to plant life and should never be used to disinfect inclosures containing live plants or fresh fruits and vegetables, as they will kill them wholly or in spots.

Corrosive Sublimate

Corrosive sublimate (mercuric chlorid) is used at the rate of 1 part to 1000 parts of water to disinfect the knife or other tools used in cutting out pear-blight. Convenient-sized tablets of this substance can be purchased at a drug store and kept in a bottle. One of these tablets may be added to a bottle containing the required quantity of water (usually a pint), and a sponge or cloth saturated with this solution may be used to wipe the tool after each cut. It is also advisable to disinfect in this way the wound made by the removal of the blighted wood.



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Caution—Taken internally, corrosive sublimate is a deadly poison and should be handled as such.

THE TREATMENT OF SOME IMPORTANT DISEASES

Apple Diseases

Scab (Venturia Inaequalis)—Spray with Bordeaux mixture (either the 4—5—50 or the 5—5—50 formula), as follows: First, when the cluster buds have opened and exposed the flower buds; second, just after the petals have fallen; third, a week or ten days later; and, fourth two weeks after the third spraying. In a rainy season this disease is rather difficult to control and may require five or six applications. In case of a dry spring, however, only three applications are usually required.

Bitter-rot (Glomerolla Rufomaculans)—Beginning thirty to forty days after the fruit is set, spray thoroughly with Bordeaux mixture at intervals of two weeks

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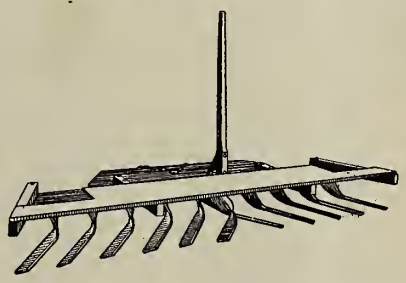

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During the past thirteen years we have built up a reputation for *quality* that has enabled us to handle crops grown by members of the Local Union as well as other growers, at price above what they could otherwise secure.

Our mission is to give the growers good prices, and the buyers fruit of such quality as will enable them to make satisfactory profits.

Our specialties are APPLES and STRAWBERRIES, but we handle all kinds of fruits grown in this section, including Pears, Plums, Cherries, Blackberries and Raspberries. If you are a buyer write us. If a grower call and see us, or telephone Main 71.

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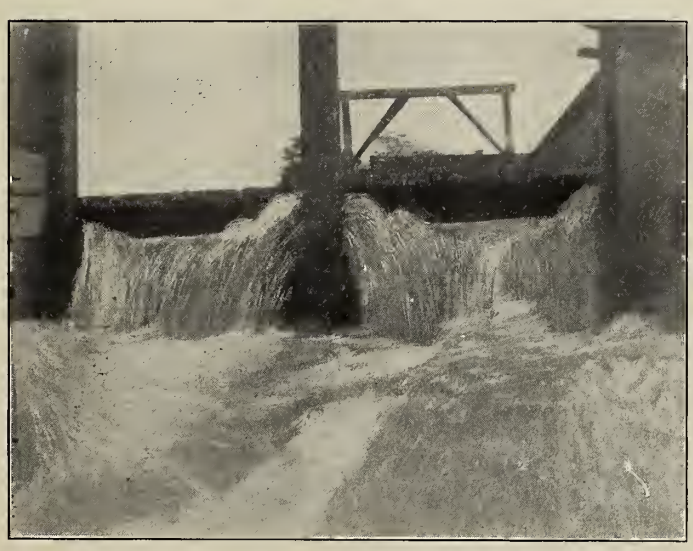
until five or six applications have been made. This treatment should be in addition to any previous applications that may have been made for scab, but in case treatment for the latter disease has been omitted the first application for bitter-rot should be made not later than thirty days after the fruit is set. Recent experiments conducted by Mr. W. M. Scott, of this Bureau, show that the bitter-rot may be thoroughly controlled by the treatment outlined.

So far as practicable, gather up and burn during the autumn and winter all of the rotten or mummified fruit; also cut out and burn all the limb cankers. These precautions are particularly desirable where a thorough course of spraying has not been properly carried out.



Where the Water Leaves the River for the Irrigon Ditch

Black-rot (Sphaeropsis Malorum)—The treatment for black-rot is the same as that for apple scab.

Pear-blight, Fire-blight, or Twig-blight—The treatment is the same as that given below for this disease of the pear.

Leaf-blights (Phyllosticta spp. and Sphaeropsis Malorum)—Two or three applications of Bordeaux mixture at intervals of ten days to two weeks, beginning when the trees are just in full foliage, will ordinarily prevent these diseases. The treatment for apple scab or bitter-rot will prevent these diseases also.

Flyspeck (Leptothyrium Pompi)—Bordeaux mixture thoroughly applied about the time the fruit is one-fourth grown and repeated two weeks later may be expected to prevent this trouble very effectually.

Canker (Glomerella Rufomaculans, Sphaeropsis Malorum, and Nectria spp.)—Remove affected branches so far as practicable, cut out or scrape the remaining cankers, and paint the wounds with white lead.

Powdery Mildew (Sphaerotheca Mali)—This disease is preventable by spraying with ammoniacal solution of copper carbonate. On nursery seedlings four to six applications may be necessary at intervals of ten days to two weeks, beginning as soon as the foliage is out.

Rust (Gymnosporangium spp.)—Spray with Bordeaux mixture as soon as the blossoms have fallen and again a week or ten days later. These are the same applications as the second and third treatments for apple scab. The disease is only partly preventable by this treatment. This fungus has its alternate generation on the red cedar, producing the so-called cedar apples. Removal of the red cedars in the neighborhood of the orchards has been recommended.

Pear Diseases

Blight (Bacillus Amylovorus)—Cut out at all seasons, but especially cut out hold-over blight in late autumn and again in spring before the blossoms open. In cutting blight, disinfect knives and tools as well as cut surfaces with corrosive sublimate solution (1 to 1000). Prune the trees so that fruit spurs are borne on fruiting branches rather than on the main limbs. The vase form of growth, with the spurs removed from the main branches, is especially recommended. All frame work branches should be repeatedly forked to facilitate the future cutting.

Leaf-Blight (Entomosporium Maculatum) — Spray with standard Bordeaux mixture after the trees are in full foliage, one to two weeks after the blossoms have fallen. Follow with second and third treatments at intervals of two weeks. This treatment is very successful.

On pear seedlings and nursery stocks spray as soon as the leaves are out and follow with five or six treatments at intervals of a week or ten days, or until new leaves cease forming.

Canker (Sphaeropsis Malorum)—Prune out the diseased twigs and branches as far as possible, cut out the cankered spots, and disinfect the wounds. Spray the trees when dormant with Bordeaux mixture until they are coated. A second spraying after the first has dried will be especially effective.

Quince Diseases

Black-rot (Sphaeropsis Malorum)—The treatment is the same as for apple scab.

Pear-blight (Bacillus Amylovorus)—The treatment is the same as for blight of the pear.

Leaf-blight (Entomosporium Maculatum)—The treatment is the same as for the same disease of the pear.

Rust (Gymnosporangium spp.)—The treatment is the same as for rust of the apple.

Peach Diseases

Brown-rot (Sclerotinia (Monilia) Fructigena)—Gather and burn all rotten or mummified fruits from the trees and the ground. Prune out all twigs affected. Prune the trees so as to admit as much air and sunlight as possible. Avoid overstimulation with stable manure and nitrogenous fertilizers. Avoid as far as possible planting trees on low, wet or undrained land. Select sites having well-drained soil and good atmospheric drainage. Spray just before the blossoms open with standard Bordeaux mixture. When the fruits are one-fourth of an inch in diameter spray with 3—9—50 Bordeaux mixture. Make two or three

(Continued on page 20)

Pa

MAYWOOD COLONY: THE MARVELOUS

THREE thousand Eastern people and 3,000,000 Eastern dollars concentrated on 39,000 acres of Western land best attest the attractiveness of Maywood Colony, which is now ten years old, and which continues to grow steadily and substantially. Every physical, climatic and industrial condition necessary to sustain its past, present and future development is at hand. Only an optimist can foretell its future.

In the upper end of the Sacramento Valley, in a local valley, where the land begins to undulate in its approach toward the surrounding mountains, Maywood Colony is located. Its setting is an ideal one, nestled in this local valley of about 60,000 acres and encircled on the north, east and west by nearby mountains from six to fourteen thousand feet high. While there is practically continuous summer in this valley, perpetual snow rests on the roundabout mountains. To the eye this contrast is a source of constant admiration. The sunsets at Maywood and the surrounding scenery are of surpassing beauty.

Bordering the eastern edge of Maywood is the Sacramento River, the noblest stream in California, and destined some day to become the source of immense industrial activity. Sometime its waters will be utilized to turn innumerable power wheels, as well as to make perennial the green of the lower Sacramento Valley. A line of steamboats now plies its waters between Sacramento on the south and Red Bluff (twenty miles above Maywood) on the north. A large warehouse is located on the bank of the river in Maywood Colony, at which great quantities of freight are loaded and unloaded.

The line of the Southern Pacific Railway, which runs from San Francisco to Portland, passes through the center of the colony. Thus the colony has both rail and river transportation, and the consequent competition insures reasonable shipping rates.

The area of this colony is about 30,000 acres, and it is divided into something like 3,000 ten-acre farms. Avenues forty feet wide run east and west through the colony and are so laid out that they form blocks one-quarter by one-half mile in size, containing eighty acres each. These blocks are subdivided into eight lots of ten acres each. By this system of subdivision each and every colony lot has an avenue frontage. The average cost of these lots is $500, and the average holdings of the colonist is ten acres.

Corning, the business center of the settlement, is located in about the center of the colony complex. The town, with its additions, covers an area of one mile square, or six hundred and forty acres. Here are located the colony stores, hotels, schools and churches, the depot, postoffice and other business houses. The sustaining industry of the settlement is fruit growing. About 12,000 acres, with ninety trees to the acre, have thus far been set to fruit. With each season additional acres are set. Results attained prove the place without a peer for profitable fruit culture. The extraordinary productiveness of this section is due to the fact that the local valley is underlaid by a subterranean sea. So near is unfailing water to the surface that without irrigation every variety of fruit—the lemon and orange alone excepted — grows and matures to perfection. For best results the lemon and orange must, wherever planted, have surface irrigation. Average depth to water throughout this local valley is twelve feet. It is to this water that the apricot, almond, olive, fig, grape, peach, pear and prune trees send their roots. Then, no matter how long the summer may be, no matter how dry the surface of the soil may become, these trees remain vigorous, for they receive from below the sustenance they require. For year around crops of vegetables and alfalfa irrigation must be employed. The abundance of water, and its nearness to the surface, renders irrigation by pumping both easy and economical. A gasoline engine and pump, that costs less than $200, raises water in plenty for the irrigation of five acres of garden. A windmill will supply all the water wanted for the house and the home acre.

To provide a profitable and dependable market for the product of the settlement, the colonists have erected and equipped an up-to-date cannery, a drying plant and an olive pickling plant. These provide a means of converting the colony crop into commercial form. The canned and dried fruit of Maywood Colony has already earned a good reputation throughout the East, and is in constant demand at paying prices.

The foremost features which have operated in the upbuilding of this community are a rich soil, rare climate, ample rainfall, exceptional healthfulness, convenient market, good shipping facilities, pleasant social conditions, and a perfect working organization. This organization has done much to popularize the Maywood Colony proposition, particularly among professional people; for by this plan non-resident lot owners can have their land planted, the trees tended and the fruit picked and sold. Hundreds of absentees have taken advantage of this plan. While their trees were growing they have remained free to attend to their trade or profession, and in so doing earned many times as much money as they could have saved by doing their own orchard work. Besides by this contract plan the non-resident has not had to invest in horses, harness and tools to do the work, nor in a barn for the horses, nor hay to feed them. He has not had to throw up a position or business, nor transfer his residence. By this plan the absentee can remain at his home so long as he wishes to, and the orchard so grown can be treated as an investment until such time as it is deemed expedient by the owner to move to and make the place his home. Generally speaking, Eastern folks have fared better by having their land planted and brought to maturity before moving to it. With their orchard brought to an income condition they are in better fix to let loose of what had previously sustained them. The cost of raising an orchard by this plan is about $40 per acre for the first year, and then $12.50 per acre for years following the first. The cost of the first year is made up of three items: preparation of the soil; the nursery stock, or young trees, and their planting, trimming and tending for the first year. Preparation of the soil means putting its surface on grade so that during the rainy season such water as does not soak into the soil will run off of it. Land upon which the water stands will not grow good trees. The exact cost of the item of grading cannot be set until the work has been done. Some lots have a surface so perfect as to require no leveling at all. Some can be graded for $2.50 per acre, while in a few instances as much as $10 per acre, or $100 per lot, has to be expended. It is safe, however, to say that the average cost of grading is not in excess of $5 per acre.

The cost of trees depends upon the variety. This season olives cost 20 cents, almonds 12½ cents, figs 15 cents, peaches 15 cents, prunes, pears and apricots 10 cents each. A fair average is 15 cents per tree. Ninety trees are set to the acre. All of these trees are home-grown, and are consequently acclimated. None but the tried and staple varieties are propagated.

Planting the trees, which includes staking off the land, digging the holes, setting the trees, trimming, and in all ways tending them through their first season, costs $25 per acre. By this we find that the average cost of grading is $5 per acre; average cost of young trees is $13.50 per acre, and the cost of planting and tending is $25 per acre, making the first year's cost of raising an orchard $43.50 per acre. The payment of this item is so arranged that it can be made in installments.

The annual cost of maintaining an orchard after the first year is $12.50 per acre, or $125 for a ten-acre lot. The payment for this item is also arranged so that it can be provided in easy installments.

The climate of Maywood is as good as the best that California has to offer, and the exceptional healthfulness of the place is much appreciated by those who live here. The atmosphere is invigorating and healing to weak throats and lungs. While there are hot days, and cold mornings, and strong winds, the heat never causes sunstroke, nor even a prostration; the cold never hurts the orange or lemon trees, and the wind never overturns houses or trees. The days are never too hot to work, nor the nights too hot to sleep. The average temperature for the 365 days of the year is 64 degrees. Such climatic conditions make the sick well, and the weak strong.

Another element to which is due not a little of the healthfulness of the Maywood Colony country is pure, soft water. Through this region the water lays in strata of fine gravel, which serves as a filter. If one will but stop to think of the amount of water consumed, and of its effect either for the benefit of health or to its detriment, he cannot fail to appreciate the importance of drinking water that will help rather than hurt the system. The water in this section is known to be a mild solvent, always relieving bladder, kidney and urinary affections.

I do not hold out the hope that all who come here in ill health will be cured and made strong. Neither do I wish to convey the idea that a man can accumulate a fortune from a ten or twenty-acre farm in Maywood. But I do claim that a man of industry and intelligence can draw from a ten or twenty-acre farm a wealth of things that go to make up a pleasant life. Here, at Maywood, the fruit growers enjoy good air, good water, abundance of fruit—which is one of nature's best medicines, fresh vegetables, milk and eggs, and working hours to suit himself.

Here nature helps, but does not hinder. The rigors of winter do not consume the earnings of summer. The horse and the cow do not have to be housed, but keep in good condition in the field or pasture the year round. Less of fuel and clothing is required to maintain comfort. Both the doctor's bill and the drug bill are reduced to a minimum. The wage-worker earns about the same amount of money during the winter that he does during the summer. Here, the wife enjoys the best society—society that is not bought and paid for. The children go to good free schools.

All in all a truly good country this. If you would know more about it, write me, or come and see for yourself.

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F. W. SETTLEMIER
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THE USE OF FUNGICIDES

(Continued from page 17)

additional sprayings at intervals of ten days to two weeks.

Caution—Even the weak mixture here advised injures the foliage more or less, sometimes resulting in complete defoliation. Spraying is therefore advised only when conditions are such that the loss of the crop is anticipated. Young growing trees are less injured by the spray because they are continually forming new leaves.

Leaf-curl (Exoascus Deformans)—Spray when buds are dormant, three or four weeks before the blossoms open, with Bordeaux mixture, copper-sulphate solution, or lime-sulphur-salt solution. Each is effective against the leaf-curl fungus. Copper sulphate is the simplest and cheapest, but Bordeaux mixture persists and is more effective against Monilia and other fungi, and is therefore preferable where these are to be fought; while the lime-sulphur-salt solution is, in addition to its fungicidal action, one of the best known remedies against scale insects.

Scab (Cladosporium Carpophilum)—Spray as for brown-rot. This treatment will be successful except in extreme cases.

Pustular spot (Helminthosporium Carpophilum)—Spray as for brown-rot. Probably fewer treatments are necessary for success.

Yellows—Find every case by inspecting all trees during the ripening of the fruit. Second and third inspections are desirable. Pull up and burn all infected trees as soon as discovered, no matter how slightly affected. This treatment is very successful when thorough, the disease being one of the easiest of all orchard diseases to control, especially when the fight is carried on systematically throughout a community. Complete eradication is difficult.

Rosette—This disease is controlled with ease by the same treatment as for yellows, except that inspection should be early in the season.

Little-peach—The treatment is the same as for yellows, but the early symptoms are more difficult to recognize. On this account the disease may be harder to control.

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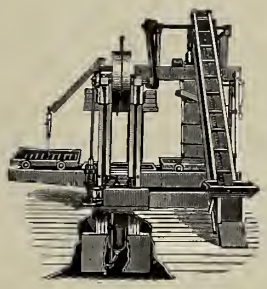

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Plum Diseases

Brown-rot (Sclerotinia Fructigena)—See treatment of the same disease under peach.

Black-knot (Plowrightia Morbosa)—During the autumn and early winter cut out and burn the knots. Make the cut 4 or 5 inches below the visibly infected portion to insure the removal of all the fungus threads. During the summer watch for and remove the new knots as soon as they appear.

When the disease is very troublesome spray with standard Bordeaux mixture when the buds begin to swell in the spring, and repeat with peach Bordeaux mixture soon after the blooming period.

Leaf-blight (Cylindrosporium Padi)—Spray with Bordeaux mixture as soon as the blossoms are shed, and repeat two or three times at intervals of two weeks. In the case of the Japanese plum, use the peach Bordeaux mixture.

Yellows—The treatment is the same as that given above for this disease of the peach.

Rosette—Treatment the same as that given above for peach rosette.

Little-peach—Follow the recommendations given under peach.

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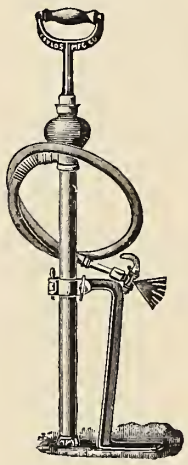
Cherry Diseases

Brown-rot (Sclerotinia Fructigena)—The treatment should be the same as that for the same disease of peach.

Black-knot (Plowrightia Morbosa)—Use the same treatment as that recommended for black-knot of the plum.

Leaf-blight (Cylindrosporium Padi)—Spray with Bordeaux mixture as soon as the foliage is out, and again ten days or two weeks later. In severe cases a third and a fourth application may be necessary. On nursery trees the new leaves must be sprayed as they appear through the season.

Powdery Mildew (Podosphaera Oxyacanthae)—Spray with Bordeaux mixture about two weeks after the leaves are out and repeat two or three times at intervals of ten days. In case of nursery stock about six applications may be necessary.



BORDEAUX BUCKET PUMP
Portland Seed Co., Agents, Portland, Ore.

Grape Diseases

Black-rot (Guignardia Bidwellii)—Clean up and burn all dead branches, leaves, and rotten fruit of the previous year in early spring. Spray with Bordeaux mixture when the buds are swelling, so as to cover all the wood posts, trellises, etc., as well as the vines. Ten or twelve days later, when the grapes are in bud, make the second treatment. The third treatment is made when the fruit has set. Repeat the sprayings at intervals of ten days to two weeks until the fruit approaches maturity. To avoid discoloration of the fruit the ammoniacal copper carbonate solution may be substituted for the Bordeaux mixture for the last two sprayings. In an average season six treatments should be sufficient, but in a rainy or unfavorable season eight applications may be required for successful results. In a rainy season or in unfavorable localities, especially in the South, Bordeaux mixture containing less water, namely, the 6—4—25 formula, may be used.

Anthracnose (Sphaceloma Ampelinum)—The treatment is the same as for black-rot, except that iron sulphate solution is preferred by some for treating the dormant vines.

Downy Mildew or Brown-rot (Plasmopara Viticola)—Treat the same as for black-rot, except that the first two or three sprayings may be dispensed with, as this disease does not appear early in the season.

Powdery Mildew (Uncinula Necator)—This disease is usually not serious enough to demand treatment, but, when necessary to spray, use the ammoniacal solution of copper carbonate, giving from three to five treatments at intervals of ten days to two weeks, beginning after the fruit is well set. On the Pacific Coast and on vines grown under glass dusting with flowers of sulphur is successful.

(To be concluded in May number)

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AND AGRICULTURAL
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ABOUT IRRIGON

THE liveliest and one of the newest of all new irrigation towns, is situated on the Columbia river 179 miles from Portland, and only seven miles from the junction of the Spokane branch, and the through line of the U. P. Railway, on the O. R. & N. Company's road in Oregon. Being so situated, it has a decided advantage in transportation facilities. It is located on the banks of the Columbia, and the lands embraced in its irrigating system extend from its dam on the Umatilla river, nine miles to the east, to Coyote on the west, giving about twenty miles of frontage on the incomparable Columbia river. Ten thousand acres of land are embraced in the present system a large proportion of which is flat, some being rolling, but all being capable of irrigation at a comparatively small cost per acre.

In purchasing land in an irrigated district, the first desideratum should always be the sufficiency of the water supply; and the second, which is just as important, the stability and reliability of the plant, such as dam. flumes and ditches.

The water supply for the Irrigon project comes from the Umatilla river. For the diversion of this water this Company has constructed all told, one of the most complete and economically maintained irrigating plants extant, consisting of a massive timber dam, supported by a twelve-inch concrete base. and held firmly in place by large Norway iron drift bolts set in solid bed rock. This dam is absolutely water tight and of equal height of main flume, which has a capacity for diverting 150 cubic feet of water per second of time. The flume is of the best possible construction, and part of the way is through solid rock. All timber is treated with wood preservatives at the joints.

All planks were bored at each end by hand for every spike. so that there will be no splitting, and the entire flume treated on the inside with crude oil and asphaltum, and in such manner that it is perfectly water tight, and yet cannot shrink, swell, crack or warp, and all setting on solid rock.

The ditch to accommodate this water has but one foot of fall to the mile; the banks have a slope of two and one-half on one, and it has been thoroughly plowed, harrowed and puddled with clay and silt, and rolled in such a manner as to make it nearly impervious to water, thereby reducing the loss from seepage to the minimum. Its smaller flumes are of what are known as the "half-barrel pattern" built on most substantial foundations, strongly and firmly bolted, and all thoroughly treated with wood preservatives to prevent any decay or injury from the elements. Wherever possible, the cement pipe system is used for distribution of the water from the main canal and laterals to the different tracts —6. 8 and 10-inch and even larger pipes are used and laid so that there is no leakage. no evaporation, no waste, and all water is distributed just where it is wanted, and at the proper time. Several miles of this pipe have been laid this season, and more is under contemplation for next.

Each part of the ditch, flumes and pipe lines are properly proportioned to handle the amount of water needed to give each district under the system, and each individual, the just proportion of water without any question, and diversion boxes will be employed, of the latest and most

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B. F. STEVENS . *2d Asst. Cashier*

improved patterns, for the satisfaction of the users. All lands are carefully contoured, areas computed and water allowances made, and no more land is sold in any district than its branch ditch and flume have ample capacity to serve.

There are at the present writing about twenty-five miles of main canal and laterals, and five miles of cement and wood stave pipe lines laid embraced in the system, and many more miles are under contemplation for next season.

Climate

The climate is very desirable. An Eastern man naturally supposes that a country situated so far north is not without its heavy frosts, cold rains and zero weather, as known in the Middle West and Eastern States, but such is not the case. No destruction has ever been recorded here from hail storms or heavy rains. In fact, it is free from excessive storms and late spring and early fall frosts. The temperature during the winter months seldom reaches the zero mark. and then for only a few days at a time, with a mean temperature in January of about 34°. Sunshine is almost continuous in Irrigon; spring appears in advance of the calendar. In February the frost leaves the ground, and by the first of March farming operations are fairly under way. The winds are generally from the southwest, coming from the snow-covered mountains of the Cascade range. The warmest months of the year are July and August, but even they are not generally uncomfortable, on account of the dry atmosphere and cool nights.

Water

Irrigon has an abundance of pure water, being situated on the Columbia and Umatilla rivers, ample water is assured at all times for irrigation.

The drainage of this country is perfect, the soil being open and porous, sloping gradually to the great Columbia river. From thirty to sixty feet below the surface a great abundance of clear, pure, soft water is found, and wells pumped with gasoline engines are not lowered perceptibly.

It appears to be a great sheet of water, flowing into the river from mountains further south, or downward and east with the river, as it is seen seeping into the river in various places.

This abundant and most excellent supply of water is a supreme consideration. Such a supply is very rarely found in an arid region where irrigation is necessary. With the surface irrigation and the perfect natural drainage, and this easily obtained, pure soft water for domestic purposes, the conditions here are extremely favorable for truck farming, gardening and fruit growing.

The soil is sandy loam, the mineral elements in perfection for quick and heavy growth of all vegetation, whether of garden, small fruits, tree fruits, grasses, alfalfa, grain or vegetables.

The most delicate. deciduous fruits and nuts, including almonds, are successfully grown.

It is very easily cultivated, as it is so porous that surface or a very light tillage is all that is deemed necessary. With irrigation, the soil becomes more compact, and it will always be the perfection of garden soil.

The application of water works like magic. Peach and apricot trees, and all semi-tropical fruits put on a growth of 5 to 8 feet each year, and the trunk of two-year-old trees measure from 8 to 11 inches in circumference. Small fruits grow in abundance, and grapes and

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Choice Roses, Lilac Althea, Plants of all kinds. Gladiolas a Specialty. Gooff Hybrids 60c per dozen; Lemoine and Gaudomsis, mix 50c; White and Light mix 75c; Best Scarlet, equal to the Cauma 75c postpaid.

All large blooming bulbs. We grow them by the thousand and know better mixtures cannot be had

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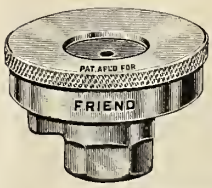

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We have as a result of repeated experimenting produced a Spraying Nozzle that is entirely new. In appearance it is like the picture, but its peculiar shape inside makes it possible to spray with the so-much-desired fine mist and do it with one-half the usual pressure. It will pay for itself the first day, because it saves your hose and makes extremely high pressure on the pump unnecessary. It makes hand pump spraying real fun. It is different from any other, yet it possesses every advantage of the heretofore "Friend." You who are reading this ad. have never seen it; if you want one, get your order in quick by sending to us $1.55. To you who have our nozzles previous to this date, mail the nozzles and 10c in stamps for postage and packing and you will be put up to date free of charge. We are busy making power machines, hand pumps, nozzles, and the new ball shut-off, yet we will take care of you if you hustle.

WARNING.

We, the Friend Manufacturing Company, hereby warn all persons that we will vigorously prosecute any and all infringements on our "FRIEND" NOZZLE AND SHUT-OFF. All necessary legal steps have been taken to give us proper protection, and we are full prepared to defend our rights.

Friend Mfg. Co.
GASPORT, NEW YORK

FOR THE

Codling Moth

and ALL LEAF-EATING INSECTS SPRAY WITH

Swift's Arsenate of Lead

IT IS WHITE & IT STICKS

Ordinary Rains will not wash it off. No matter how strong it is used, there is absolutely no danger of burning or scorching.

After investigating results obtained with Swift's Arsenate of Lead in California and Colorado, a few Hood River growers decided to try it in 1905, and we used about 2000 pounds. Those who did had the cleanest crop they ever had with far less stung apples than their neighbors who used other formulas. In a word, the result was so satisfactory that every grower in Hood River Valley is using it this year. We used 2000 pounds in 1905 and a carload in 1906.

E. H. SHEPARD, Manager,
Hood River Apple Growers Union.

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NORTHWESTERN AGENTS

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For Sale in Hood River by the Hood River Apple Growers Association

loganberries send out shoots of from 10 to 20 feet, and even more.

The condition of the soil and climate makes this a highly desirable region for raising poultry.

Transportation

The town of Irrigon is situated on the banks of the Columbia river, on the main line of the O. R. & N. Company (a portion of the Union Pacific system), giving direct access to all points in the interior, in the East and to the Orient by way of Portland and through its own lines and connections to Seattle, San Francisco and all points North and South.

On the opposite side of the Columbia river, there is being built the Portland and Seattle Railroad, which extends along the north bank of the Columbia river, from the crossing of the Northern Pacific Railroad on its old line to Seattle at a point 49 miles above Irrigon by the river, and winds below the bluffs and palisades of the Columbia to Portland.

Between these great roads lies the Columbia river, the volume of which at lowest stages is in excess of that of the Mississippi River immediately below the mouth of the Ohio. This river drains a larger area than all Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Delaware and Virginia. It is navigated by ocean vessels and up the Willamette to Portland, 100 miles from the ocean. River steamers run from Portland to The Dalles, ninety miles. The United States is now building a canal and locks about eight miles long at Celilo Falls, ten miles above The Dalles, making a through waterway for the upper river steamers.

Two steamers regularly land at Irrigon. Other steamers are building for this upper river service.

A ferry line connects Irrigon with the north bank of the Columbia river.

The prices for Irrigon land are low, when the location and other natural advantages are taken into consideration. The Irrigon season is early and long, and fruits and vegetables mature fully two weeks earlier than other Northwest districts.

It is needless to say that the Irrigon system, with its thousands of acres and abundance of water, will soon be one of the most populous and prosperous in the West.

Cashmere, Wash., March 23, 1907.
Better Fruit Publishing Company,
Hood River, Oregon.

Dear Sirs: I have just finished reading your March number. I am "from Missouri" and you have "shown me" conclusively the superior merits of "Better Fruit." Enclosed find one dollar for a year's subscription; begin with the March number which you sent me a few days ago. I received the January and February numbers, and that is enough of a good thing free.

I have been reading horticultural papers for a good many years, and I will say this for "Better Fruit": It is in my estimation the most practical and valuable journal of its kind. Indeed, it is in a class by itself.

Thanking you for the free numbers, I am, yours truly.

O. M. BROOKS.

I enclose 10c additional. Please send me the November number.

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Try a pair of American Lady $3 & $3.50 Shoes or American Gentlemen $3.50 & $4

Get a CENTURY SPRAY PUMP

Whale or Electric—a Spray Hose that you can rely upon. A Bordeaux or Vermorel Spray Nozzle. Then go for the Codlin Moth. We have them here.

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BETTER FRUIT

HOOD RIVER, OREGON

A Monthly Illustrated Magazine Published in the Interest of Up-to-date Progressive Fruit-Growing & Marketing

All Communications should be Addressed and Remittances made Payable to the Better Fruit Publishing Company

E. H. SHEPARD, Editor and Publisher
H. D. WALTON, Associate Editor

SUBSCRIPTION PRICE $1 PER YEAR
IN ADVANCE IN THE UNITED STATES & CANADA
Foreign Subscriptions, *Including Postage, $1.50*
ADVERTISING RATES FURNISHED ON APPLICATION

Entered as second-class matter December 27, 1906, at the post office at Hood River, Oregon, under the act of Congress of March 3, 1879

MR. E. H. Shepard having purchased the interest of E. A. Franz in "Better Fruit," he assumes full charge, and begs leave to assure the many readers and enthusiastic supporters and admirers of "Better Fruit" that it will be his earnest endeavor to continue "Better Fruit" true to name, and make it better in every way possible. Already the size has been increased from 28 to 32 pages, and we believe this number will prove to be one of the most instructive and valuable ever published.

WE have had a number of orders for complete files, which we have filled. We want to make a few more complete files, and will pay 50 cents each for a dozen copies of the July or October number. If you have a clean copy of either of these numbers, send us a postal card, and we will send you 50 cents per copy until we have secured a dozen of each.

Our Big Four Offer

THE large number of subscriptions we have received for the World's Work combination offer including "Better Fruit," and the Review of Reviews offer along the same line is splendid evidence that "Better Fruit" is reaching an intelligent class of readers, and these subscribers and readers are fruit growers, consequently it is also evident that subscribers to "Better Fruit" are intelligent and educated as well as literary people. If you have not already taken advantage of this offer, do so now; the offer appears in another column.

ANY one subscribing to "Better Fruit" and accompanying their subscription with one dollar, the regular price per year, upon request will receive complimentary any one of the following back numbers, as long as they last:

September number, the best treatise on packing ever published.

November number, the edition containing the most thorough treatise on anthracnose, descriptive, preventive, and remedial.

The December issue, giving the most perfect description of San Jose scale, and the most effective treatment. Each of these editions have these special subjects comprehensively illustrated, and without doubt each of these specials surpass anything ever before published in any horticultural journal. If you want all three, send in three subscribers including yourself, and three dollars.

Notes by the Editor of "Better Fruit" on Spraying

WE have published the article on "Codling Moth," by Marlatt & Orton, of the United States Department of Agriculture, because the government works are considered reliable and of a general nature. No one can go far astray. This article contains much information of a general nature of value to every orchardist. However, conditions in some localities are not general, and the dates to spray must be determined by the rational method. It is our intention to publish an article on "Rational Determination of Spraying Periods" in the next issue, which will appear in ample time for the sprays following the calyx spraying. Particular attention is called to the article on spraying for "Codling Moth." by A. L. Melander, of the Experimental Station, Pullman, Wash., appearing in this issue. Of course, it is understood that his observations and conclusions are made in the State of Washington. and therefore apply more particularly to such conditions as exist in that State. If we are correctly informed most of his experimental work was done in Yakima Valley.

In Hood River Valley growers sprayed the first time before the last petals had fallen, and generally immediately following, that is, within a week, with a second spraying, and then with the third ten days afterwards. This method introduced an intermediate spraying between Melander's first and second spraying which demands an explanation. The blossoming period of Hood River is generally an extended one, and the general opinion of growers is that when the first spray is put on, which is before all the petals have fallen. some of the calices are just right to receive the poison and hold it—a little later they would be closed—while some of the calices of the later blossoms are not far enough advanced to sufficiently hold the poison. therefore this intermediate spraying in Hood River Valley.

Times for later sprayings are determined in the same manner in Hood River as by Melander. It must be admitted that no experiments have been made in Hood River Valley to determine the value of this intermediary spraying, for the reason the experimental station of the State of Oregon has never carried on any experimental work here, and as a rule growers do not have the time to go into detail work to make exact and definite determinations.

MR. Chris Greisen, who is one of the manager's assistants in the Hood River Growers' Unions, between seasons has been showing a complete file of "Better Fruit" to growers in the various fruit districts surrounding Hood River. He says this is about all that is necessary to get a subscriber. As evidence of this fact, he has secured three hundred subscribers in less than thirty days, and done what horticultural papers say don't pay, for he has made it pay.

Our Spray Number

THIS April edition, we believe, is the most up-to-date and thorough number in all kinds of spraying, particularly for the Northwestern locality, ever published. Tell your friends if they want it to subscribe. It is worth a dozen times the price of subscription. We believe it is a number every fruit grower should have and keep.

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Spraying Materials: Paris Green

THERE are so many different sprays for codling moth, and conditions are so different, that no one can at present assume to say that any one make is best for all conditions and localities. I heard Prof. E. D. Ball talk on spraying for codling moth at Portland in 1903; at Boise in 1904, and at La Grande in 1905, and at the latter place he gave the most thorough and able address that I ever had the pleasure to listen to. He prefaced his remarks by stating that his experiments were confined to Utah, an arid region. In that locality there is scarcely any rain or dew during spraying season, consequently he was able to use Paris green with little if any risk of burning the foliage or apples. The results of his experiments were practically a clean crop. but in humid climates a different condition exists. and in Pajaro Valley, California, Paris green has been practically abandoned.

Dust Spray—There are many strong adherents of dust spray, particularly in Missouri, and this year at the Northwestern Fruit Growers' meeting in Seattle I heard many Yakima growers very enthusiastic over success achieved with dust spray. It is less expensive, and quicker to put on. It is conceded to be a great boon in many fruit districts, for the reason that in some localities orchards are on such steep slopes that it is almost impossible to use water, while in other districts water is so scarce that it could not be had in sufficient quantities. It is admitted that dust adheres very firmly where dew exists, and its advocates also claim it sticks without dew. Extremely

windy climates without dew have not tried it sufficiently so far as I know to give definite opinions. But the strong endorsement of the Yakima growers certainly justifies anyone making the experiment.

Disparene—Is made by the Bowker Company, and is an arsenate of lead, and generally considered similar in composition to Swift's. Many favorable reports indicate it effective.

Swift's Arsenate of Lead—Perhaps of all sprays, more of this is used than any other. It was used in Pajaro Valley, Cal., Southern Oregon, and Hood River Valley very generally last year, and up to the present writing under conditions existing in these districts it has generally proved more effective than any other spray used in these localities; it has given what is practically a clean crop where properly applied.

I think these four sprays are more universally used than any others, and it might be added in districts where they have been largely used so far as I am informed are giving excellent results.

DO you want to subscribe to "Better Fruit"? If you do, send us a post-office money order, dollar bill, express order, or personal check. If this is not convenient, we are sure if you hand the dollar and your name and address to the manager of an association or the secretary of any horticultural society, he will sent it for you.

IT IS our intention in this edition to call attention to the various sprays and outfits that we have reason to believe are good, giving as much information as our limited space will permit, in order that the grower may investigate and draw his own conclusions as to what is best for him, his locality, and his conditions. We prefer this system instead of commenting adversely on some that have been reported ineffective, for the reason the latter method might do some one an injustice, inasmuch as what might not have been good last season may be corrected and effective this season. If we have omitted machines, or makes of spray that are worthy of mention, we beg pardon, and would add in way of explanation that no one sees everything, and we confess openly that we do not claim to "know it all."

THE wonderful increase in crops that can be secured by an intelligent use of fertilizers is beyond the comprehension of the uninformed. Potash is one of the best fertilizers of fruit we know of, as it not only increases the yield, but adds to the keeping quality and size. The advanced growers in America are beginning to realize what they knew centuries ago in Europe, that is, if the productiveness of the soil is to be maintained it must be kept up. As an illustration of fertilizing results, I will cite my own experience with strawberries. First year, no fertilizer, 150 crates average; next, fertilized, 175 crates average; next year, fertilized, 192 crates. The formula used was 100 pounds each bone meal, potash phosphate. Every man will not thoroughly or properly mix his own fertilizer; in such cases a good mixed fertilizer from a reliable house is recommended. For strawberry plants three and four years, from 50 to 100 pounds of nitrate of soda applied just at blossoming time will give marvelous results in yield, size and color.

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We have modern cold storage facilities essential for the handling of your products. Reliable market reports. Prompt cash returns.

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HAVE you seen that easy running Empire Cream Separator? They say it's a marvel! It's the talk of the students at the dairy schools, both about it's light running and close skimming. It is just what you need if you have two or more cows. The price of these machines is from $50.00 up. Send your address and receive catalogue telling all about it.

EMPIRE CREAM SEPARATOR CO.

89 NORTH SIXTH STREET, PORTLAND, OREGON

PAINT PAINT PAINT

Paint is the cheapest insurance a man can get for the protection of his property. Did you ever notice how quickly a building which has not been painted will become dilapidated, moss-covered and weatherbeaten?

In the earlier issues of this paper we advised the use of our celebrated Phoenix Lime and Sulphur Liquid Spray for the protection of orchards against fruit pests. We now urge the use of our DUNNE'S PURE HOUSE AND BARN PAINTS FOR THE PROTECTION OF YOUR BUILDINGS. We have the most modern and best equipped paint manufacturing plant in the Northwest, and we manufacture all our paint fresh for each order.

Prices and color cards sent on application.

DAVID M. DUNNE COMPANY

Paint and Spray Manufacturers. PORTLAND, OREGON

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Your Fruit Will Look Better Sell Better By Using
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Fancy Labels
We Make Them
Schmidt Lithograph Co.
E. SHELLEY MORGAN MGR.
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PORTLAND OREGON

Where to Buy a
PIANO

When Sherman, Clay & Company, the old Pacific Coast Piano House, which has been doing business at the corner of Kearney and Sutter streets, San Francisco, for over thirty-five years, purchased the piano business of Allen & Gilbert-Ramaker Co., it was everywhere admitted that it was the most significant transaction ever announced concerning the music business of the Pacific Northwest.

Important, because Sherman, Clay & Company are so well known as a staunch, reliable firm. They have a one-price system. Every piano is marked in plain figures. A child can buy a piano from Sherman, Clay & Company just as safely as can a state senator, and at the same price. They are Pacific Coast agents for the Steinway piano; also many other standard makes such as the Knabe, Everett, Mason & Hamlin, Hardman, A. B. Chase, Fischer, Packard, Conover, Ludwig, Kingsbury, Estey, Emerson, Sterling, Wellington, Huntington and Mendelssohn. Also Estey, Packard and Chicago Cottage Organs, Piano Players and Victor Talking Machines.

When you visit Portland, Spokane, Tacoma, Seattle, Everett, Bellingham or San Francisco, you should call and see the pianos exhibited by Sherman, Clay & Co. Their Portland store is opposite the postoffice, Sixth and Morrison Sts.

MOSIER VALLEY

THE fame of the Hood River and Mosier Valley fruit belt has been spread throughout the United States, Europe and the Orient; this zone of luscious fruit, known as the red apple belt, comprising the Hood River, Mosier Valley and White Salmon sections, is situated on both sides of the Columbia river, from sixty to seventy miles east of Portland, just over the crest of the Cascades, between the extreme climatic conditions of Eastern and Western Oregon.

The wonderful adaptability of this locality to the production of fruit was not discovered until recent years, the intelligent growers at once set about developing this promising industry to the greatest degree of excellency, until at this time the business of growing and marketing all varieties of fruit has advanced to a point of scientific perfection never attained in any other locality on earth.

While all species of fruit are produced abundantly, Spitzenberg and Yellow Newtown apples have been proven to be especially adapted to the soil and climatical conditions in the Mosier Valley; these varieties comprise a greater part of the commercial orchards now being planted. So great is the confidence of the growers of this industry that hundreds of acres are being set out to trees every year. There is no fear of over production, the demand increases more rapidly than the supply. It's the quality that always finds ready market at fancy prices.

Where Money Grows on Trees

With the growth of the fruit industry and the realization of such large profits, land values increased until at the present time orchards in the Hood River valley are valued at prices ranging from $300 to $2000 per acre. These figures are fully justified by the returns received from the land, many orchards netting from $300 to $1000 per acre in one crop.

In seeking a locality where all the requisites of soil, climate and shipping facilities combined most advantageously, some of the most competent orchardists have selected Mosier Valley as the most promising section in which to engage in commercial fruit growing.

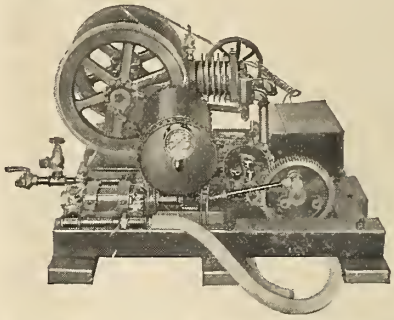
Mosier is a pleasant and thrifty community located on the O. R. & N. Railway, 66 miles east of Portland, on the southern bank of the Columbia river, in Wasco county. Most of the land is level or slightly sloping as orchard land should be, the soil is rich, of decomposed volcanic matter, deep friable, sub-irrigated and well adapted to the purpose in view, namely the upbuilding of a large commercial orchard through the efforts of many small owners.

Leading to a Prosperous Future

Here is an opportunity never before offered to the public. Secure a tract while it is available, and the few dollars invested from month to month will grow into an income as rapidly as the sap can flow into the trees, and open the way for the making of happy homes amid the delightful surroundings, where nature has bestowed her choicest gifts.

We desire to impress upon your mind the importance of this subject and superior features of the Mosier Valley Red Apple Land. A spot where every feature of the soil and the climatical conditions are favorable to the growing of first-class apples.

Wallace "Invincible" Engine Power Sprayer



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The Washington Nursery Company's plant is on the Yakima Indian Reservation where clean trees are grown in the finest soil in the world, miles removed from any old or pest-ridden orchard. Their selection, planting, budding, grafting, cultivation, packing and shipping are under the personal supervision of Mr. A. W. McDonald, who is recognized as one of the most thorough nurserymen in the trade.

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8:50		TROUTDALE		5:25
9:12		BRIDAL VEIL		5:02
9:41		BONNEVILLE		4:32
9:53		CASCADE LOCKS		4:20
10:06		WYETH		4:06
10:33		HOOD RIVER		3:40
10:45		MOSIER		3:28
11:20		THE DALLES		3:00
11:59	*Arrive*	BIGGS	*Leave*	12:15

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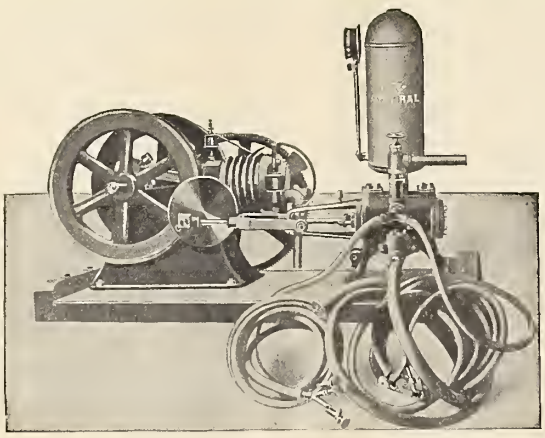

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